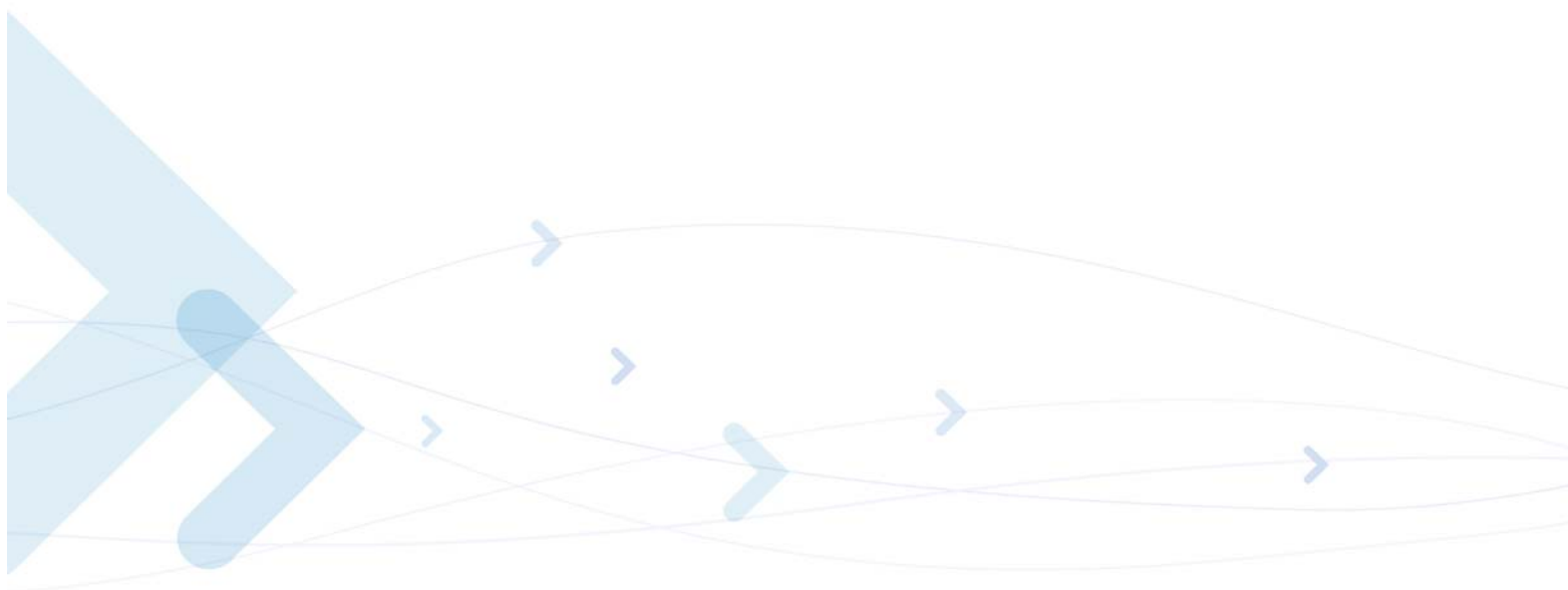


# Technical Information



## Motorola C24 Developer's Guide **AT Commands Reference Manual**

*JUNE 15, 2009*  
**6802985C51-B**

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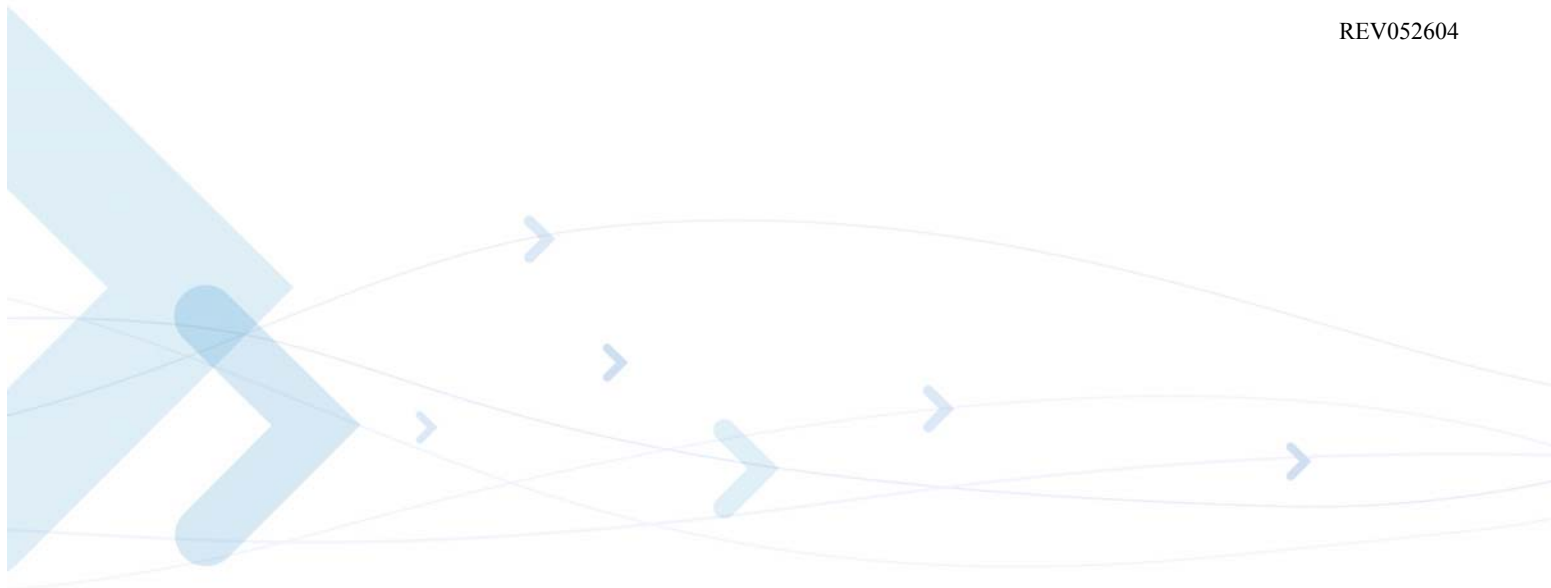
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REV052604





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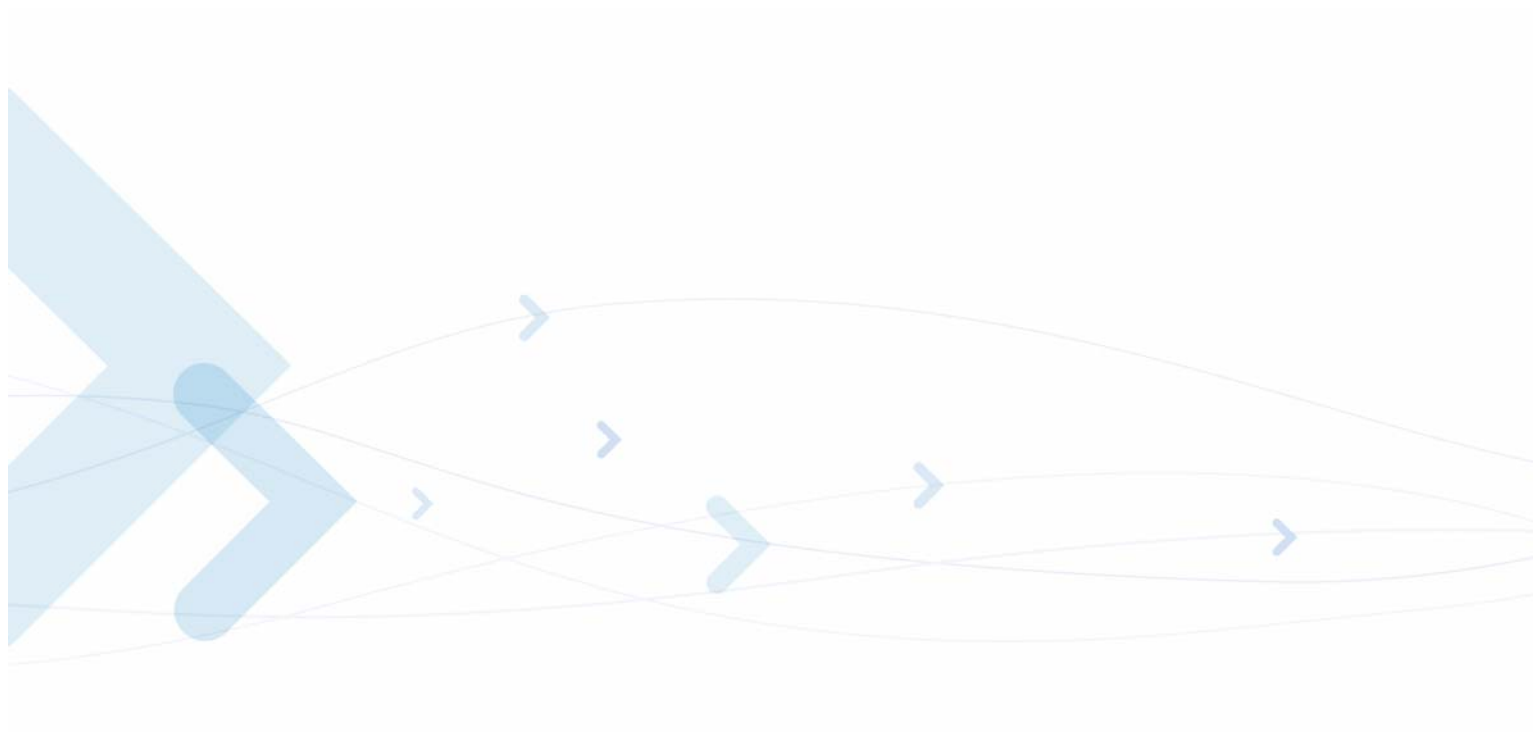
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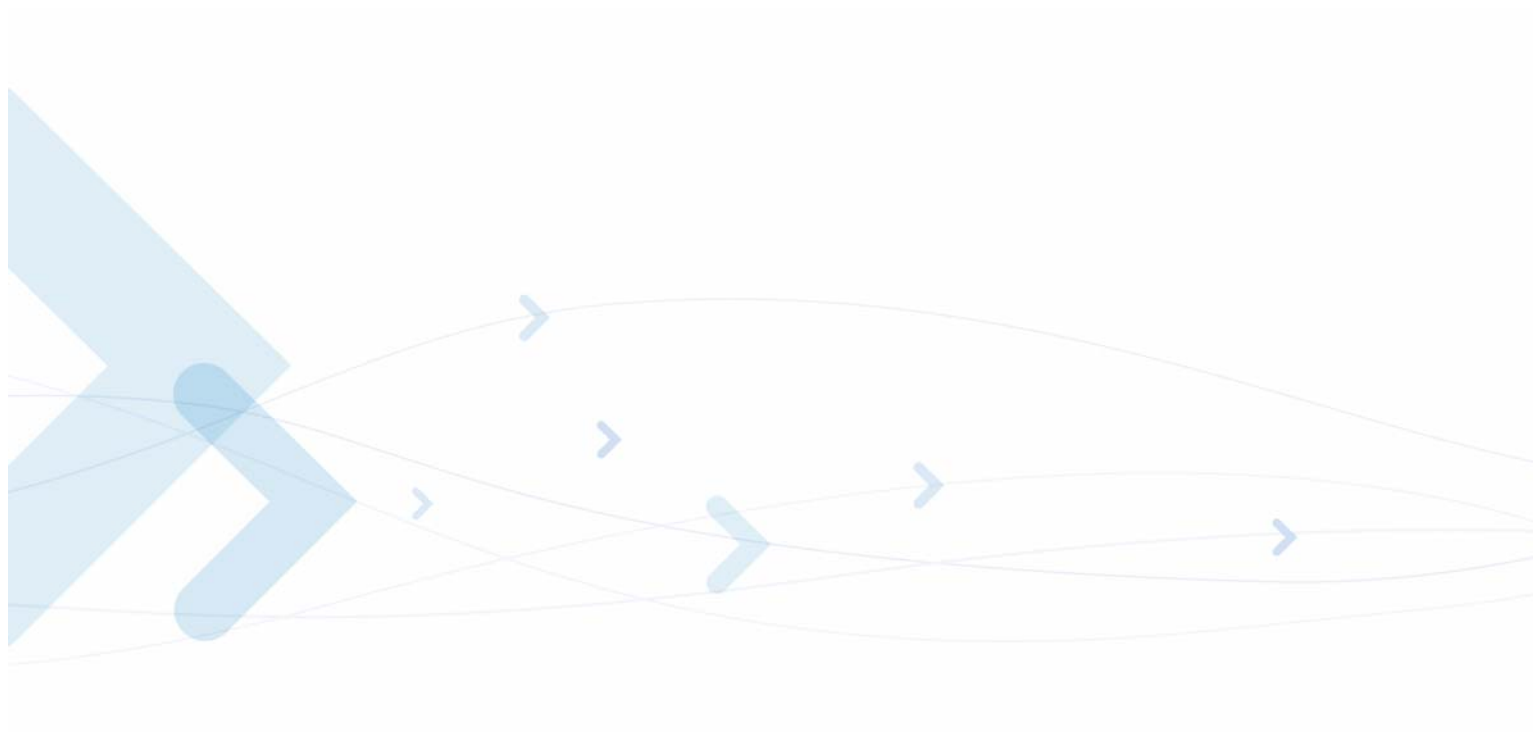
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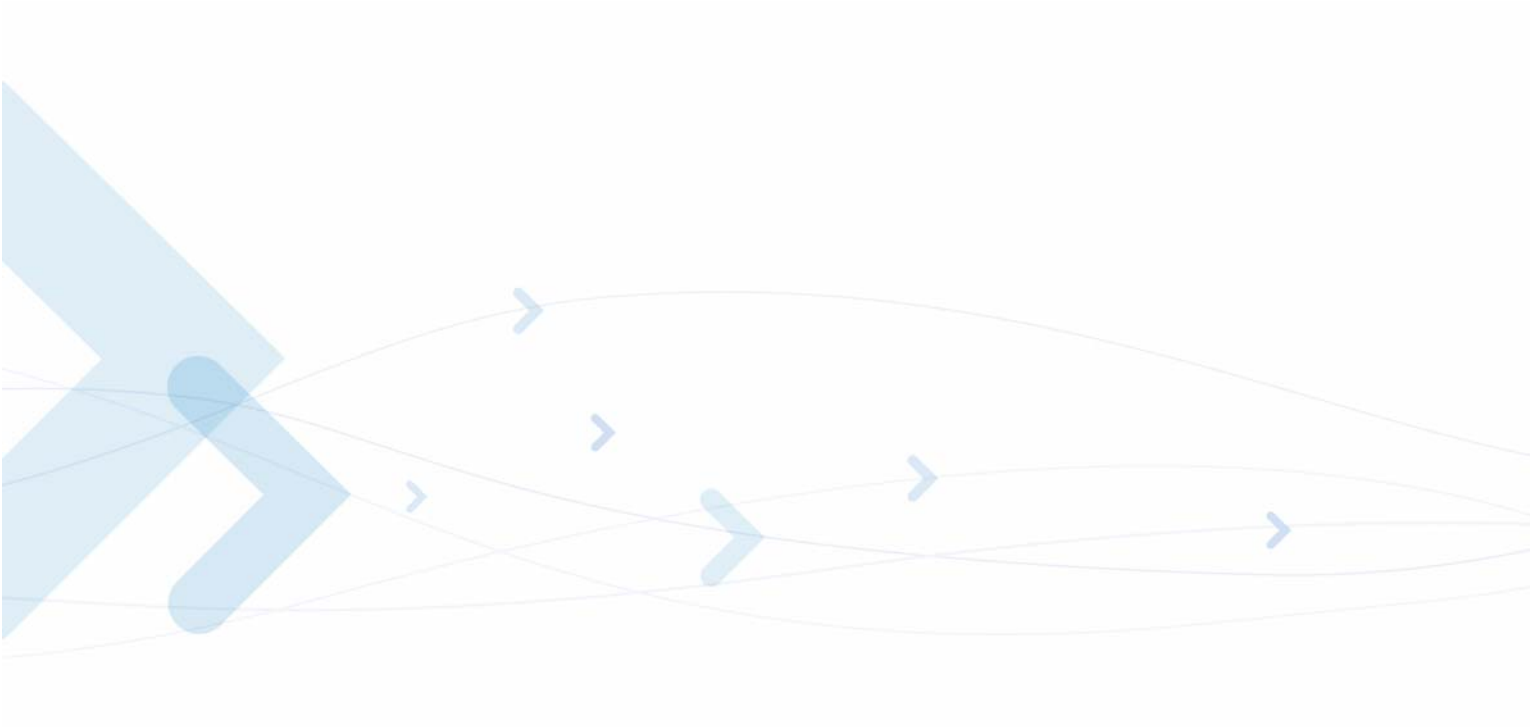
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# Preface

---

## Manual Scope

This manual introduces the C24 AT commands, and describes how software developers can use these commands to communicate with the C24 device, and to create software applications that communicate with the C24 using these commands.

**Note:** The integrator should read the corresponding SW release notes for the C24 version he is using to get information about differences from this manual.

## Target Audience

This manual is intended for software developers who communicate with the C24 device using the AT commands, and create applications to communicate with the C24 device using the AT commands.

## Manual Organization

This manual contains the following chapters:

- “[Preface](#)” provides a scope for this manual, document convention, safety instructions and a liability notification.
- “[Chapter 1: Product Features](#)” introduces the new product features and provides a list of the AT commands.
- “[Chapter 2: Introduction to AT Commands](#)” provides an introduction to the AT commands, and includes a general explanation of the command’s format and usage. It also describes supported character sets and error handling.
- “[Chapter 3: AT Commands Reference](#)” provides a reference to all available AT commands, including examples, where relevant.
- “[Chapter 4: Using the Commands](#)” provides scenarios and examples for implementing various C24 functionality, including C24 setup and connectivity, SMS, call control, data calls, 1x data call, Sleep mode, audio, TCP/IP and MUX user integration.
- “[Chapter 5: Tools](#)” describes the PC Driver and PC Loader tools provided by the application.
- “[Appendix A: Reference Tables](#)” provides conversions between different character sets. It also provides an alphabetical list of all the AT commands.
- “[Appendix B: MUX](#)” describes the MUX’s PREMUX and MUX states.

## Applicable Documents

- C24 Module Hardware Description – 6802985C52
- C24 Developer's Kit – 6802985C53

## Contact Us

We at Motorola want to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

For general contact, technical support, report documentation errors and to order manuals, use this email address:

M2M.CustomerCare@motorola.com

Motorola appreciates feedback from the users of our information.

## Text Conventions

The following special paragraphs are used in this guide to point out information that must be read. This information may be set-off from the surrounding text, but is always preceded by a bold title in capital letters:

### Note

**Note:** Presents additional, helpful, noncritical information that you can use.

### Warning

**Warning:** Presents information to warn you of a potentially hazardous situation in which there is a possibility of personal injury.

### Important

**Important:** Presents information to help you avoid an undesirable situation or provides additional information to help you understand a topic or concept.

### Caution

**Caution:** Presents information to identify a situation in which damage to software, stored data, or equipment could occur, thus avoiding the damage.

## Manual Banner Definitions

A banner text in the page footer under the book title (for example, **Preliminary** or **FOA**) indicates that some information contained in the manual is not yet approved for general customer use.

## Field Service

For Field Service requests, use this email address:

n2csfs01@motorola.com

## General Safety

### Remember!. . . safety depends on you!

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Motorola, Inc. assumes no liability for the customer's failure to comply with these requirements. The safety precautions listed below represent warnings of certain dangers of which we are aware. You, as the user of this product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

### Ground the instrument

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. If the equipment is supplied with a three-conductor AC power cable, the power cable must be either plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter. The three-contact to two-contact adapter must have the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable must meet International Electrotechnical Commission (IEC) safety standards.

**Note:** Refer to *“Grounding Guideline for Cellular Radio Installations”*—Motorola part no. 68P081150E62.

### Do not operate in an explosive atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

### Do not service or adjust alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid is present.

## Keep away from live circuits

Operating personnel must:

- not remove equipment covers. Only Factory Authorized Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly, or component replacement, or any internal adjustment
- not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed
- always disconnect power and discharge circuits before touching them

## Do not substitute parts or modify equipment

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of equipment. Contact Motorola Warranty and Repair for service and repair to ensure that safety features are maintained.

## Dangerous procedure warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions that you deem necessary for the operation of the equipment in your operating environment.

### Warning example:

---

**Warning:** Dangerous voltages, capable of causing death, are present in this equipment. Use extreme caution when handling, testing, and adjusting.

---

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## Disposal of Motorola equipment in non-EU countries

In non-EU countries, dispose of Motorola Networks equipment in accordance with national and regional regulations.

### Turkey

Article 7 of the *European Union (EU) Directive 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)*

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(\*)including without limitation loss of use, loss of time, loss of data, inconvenience, commercial loss, lost profits or savings.

## How to Get Warranty Service?

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## Claiming

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You must ensure that all and any repairs or servicing is handled at all times by a Motorola Authorized Service Center in accordance with the Motorola Service requirements.

In some cases, you may be requested to provide additional information concerning the maintenance of the Products by Motorola Authorized Service Centers only, therefore it is important to keep a record of any previous repairs, and make them available if questions arise concerning maintenance.

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1. Defects or damage resulting from use of the Product in other than its normal and customary manner.



2. Defects or damage from misuse, access to incompatible sources, accident or neglect.
3. Defects or damage from improper testing, operation, maintenance, installation, adjustment, unauthorized software applications or any alteration or modification of any kind.
4. Breakage or damage to antennas unless caused directly by defects in material or workmanship.
5. Products disassembled or repaired other than by Motorola in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim.
6. Defects or damage due to range, coverage, availability, grade of service, or operation of the cellular system by the cellular operator.
7. Defects or damage due to moist, liquid or spills of food.
8. Control unit coil cords in the Product that are stretched or have the modular tab broken.
9. All plastic surfaces and all other externally exposed parts that are scratched or damaged due to customer normal use.

Depending on operating conditions and your usage habits, wear and tear might take place of components including mechanical problems related to Product housing, paint, assembly, sub-assemblies, displays and keyboards and any accessories which are not part of the Product's in-box configuration. The rectification of faults generated through wear and tear and the use of consumable items like batteries beyond their Optimum Performance Time as indicated in the product manual is considered to be your responsibility and therefore Motorola will not provide the free Warranty repair service for these items.

## Installed Data

Please make and retain a note of all data you have inserted into your product. For example names, addresses, phone numbers, user and access codes, notes etc. before submitting your product for a warranty service as such data may be deleted or erased as part of the repair or service process.

Please note if you have downloaded material onto your product, for example ring tones, ring tunes, screensavers, wallpaper, games, etc. These may be deleted or erased as part of the repair process or testing process. Motorola shall not be responsible for such matters. The repair or testing process should not affect any such material that was installed by Motorola on your product as a standard feature.

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## Revision History

### Manual Number

6802985C51-B

### Manual Title

C24 Developer's Guide: C24 - AT Commands Reference Manual

### Version Information

The following table lists the manual version, date of version, and remarks about the version.

#### Revision History

Version	Date Issue	Remarks
<b>A</b>	December 15, 2008	Initial Release
<b>B</b>	June 15, 2009	Commands added: CPRL4, MAMOD, MBANDP, MECALL, MOTAIND, MPESND, MPESNH, MPREFMODE, MSPC, FTP capability commands. Commands updated: A, ATI, CLCC, CLVL, CMEE, CMGS, CNMI, CSMP, D>, FTPTYPE, MIPCALL, MSDNS, VTS.



# Chapter 1: Product Features

---

## Connectivity Interface

The user can establish two types of connections in order to establish an AT command session with the C24:

- RS232 connection
- USB connection

The user can use either RS232 or USB connections, but not both simultaneously.

## 1x Packet Data Operation

### Overview

The 1x data call allows the service subscriber to send and receive data in an end-to-end packet-transfer mode, without utilizing network resources in circuit-switched mode.

### Features and Benefits

1x data call enables the cost-effective and efficient use of network resources for packet mode data applications:

- Always connected.
- No setup time before data transmission.
- Cost change based on current data communication (not time based).

### Technical Description

The C24 is able to both 1x data call and other CDMA services, but can only operate one set of services at a time (1x data call or CSD).

The C24 can activate a 1x data call and at the same time be alerted for an incoming call.

This functionality is available on the C24 single serial line by either of two procedure options:

Option 1:

1. While in 1x data call, listen to the RI signal (RS232) for an incoming call ring.

2. Upon being interrupted by the RI signal, drop the DTR line to switch to command mode (depending on the previous DTR configuration: AT&D).
3. Answer the call (suspending the data call session).
4. At the end of the call, pull the DTR to resume the data call session.

Option 2:

- Use the MUX protocol for virtual channels support, with a unique channel for the 1x data call session (Data) and a unique channel for answering the voice call (command)

## CSD Operation

### Overview

Data transfer over Circuit Switched Data (CSD) is possible. Once the connection is established, data can be transferred to and from the remote side.

The user should take the CSD call setup time into account.

Network operators charge the user for the call time regardless of data usage.

### Features and Benefits

CSD operation enables the terminal to perform a data transfer over a circuit switched link.

It enables the user to:

- Connect to a remote modem without any Internet network involvement.
- Own a real IP address and enable its access by connecting to an external ISP.

The following are examples of standard CSD call uses:

- Connecting an Internet Service Provider (ISP).
- Remotely accessing corporate Intranet via Remote Access Server (RAS).
- User specific protocol, where the user defines both the remote and local sides.

## Improved OEM Features

C24 contains the following new and improved features:

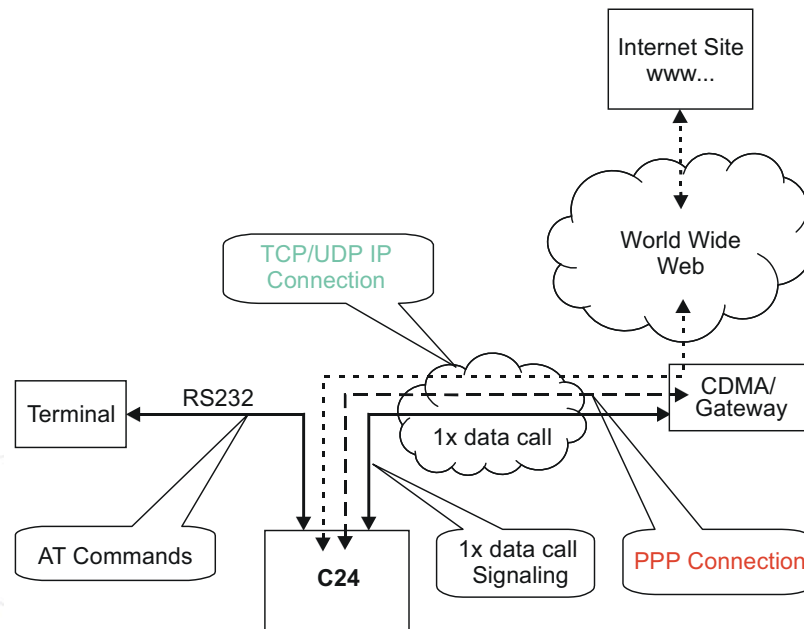
- TCP/IP support
- Audio (digital and analog) - path, gain and algorithm
- User-defined profiles

For a full list of C24 features, refer to the C24 Module Hardware Description manual.

## TCP/UDP IP Connection

### Overview

The network capabilities are achieved by using different layers of connections. Every layer of connections provides basic connections to the layer above it. The higher the layer is, the more capabilities it can provide.



**Figure 1-1: System Overview**

The three layers of connections are:

- Physical links
- Point-to-point links
- TCP/UDP links

### TCP/IP

When establishing the TCP/IP connection the C24 can only be the "initiator". The TCP/IP feature enables the C24 to be a wireless end point for a TCP/IP socket.

**Note:** The TCP protocol use the value TTL (Time to live) = 64.

### Creating TCP/IP Connections

Connection from the C24 to the Web

The following occurs when creating a TCP/IP connection from the C24 to the Web:

1. The C24 connects to the CDMA 1x network and receives an IP address (using the +MIPCALL command).

2. The C24 opens a TCP/IP stack as one of its "sockets" (it must know the target's IP address and port number).
3. Once the connection is established, data is transferred freely in both directions (upload and download).

Connection with another C24 using the "Windows Dialer"

The following occurs when creating a TCP/IP connection with another C24 using the "Windows Dialer":

1. The OEM on the target side (server) uses the "Windows Dialer" application. When using this application the TCP/IP is external to the OEM. (External TCP stack is used).
2. The target side activates the "server application" (The term "server application" means an application that has the ability to listen on a given IP address and port number).
3. After connecting to the CDMA 1x network, the "server" sends its IP address to the C24 using an alternative connection (for example, CSD, SMS and so on).
4. The server application listens on a known port, waiting for C24 to connect.
5. The C24 connects to the same CDMA 1x network as the server, and receives an IP address (using the +MIPCALL command).
6. The C24 initiates a TCP/IP connection with the listening "server". (It knows the IP address and port number of the server).
7. Once the server is connected, the TCP/IP connection is created and data can be transferred freely in both directions (upload and download).

## UDP/IP

The set of AT commands created for the TCP/IP connection is used for the UDP/IP connection as well. Therefore, UDP/IP must open a UDP stack using the MIPOPEN AT command. The connection created does not change any concept regarding the UDP/IP known protocol (which is connectionless), this is just an easy way for the terminal to specify to the C24 which of the four possible stacks should be used.

When establishing the UDP/IP connection, the C24 is both the "initiator" and the "listener".

### Creating UDP/IP Connections

Connection with another C24

The following occurs during a UDP/IP connection with another C24:

1. Side A:
  - The C24 connects to the 1x network and receives an IP address (using the +MIPCALL command).
  - The C24 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).
2. Side B:
  - The C24 connects to the 1x network and receives an IP address (using the +MIPCALL command).
  - The C24 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).
3. Side A and B previously agree on a port number, and exchange their given IP addresses via other means of connection (SMS, CSD, Voice, DB and so on).
4. The C24 sends and receives data to and from the targeted site as it knows the IP address and port number of the target.
5. Sending (accumulating) data is done using the +MIPSEND command.
6. Actual send is done using the +MIPPUSH command, by specifying the IP address and port number of the destination.

**Note:** Every +MIPPUSH sets the destination IP address and destination port number for the current and future transactions. These values are used for the next push if not explicitly overwritten.

Connection from the C24 (client/server) to WEB (client/server)

The following occurs when creating a UDP/IP connection from the C24 (client/server) to WEB (client/server):

1. Client side:
  - The C24 client connects to the 1x network and receives an IP address (using the +MIPCALL command).
  - The C24 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).
2. The C24 sends data to the Website, as the Web site's IP address is known and is public, and the port number is previously agreed upon.
3. Sending (accumulating) data is done by the +MIPSEND command.
4. Actual send is done by the +MIPPUSH command by specifying the Website IP address and Website port number.



5. Server side:
  - After receiving the first packet from the client, the server knows the IP address and port number of the C24.
  - The IP address and port number for the specific mobile C24 should be saved in the DB.

**Note:** Every +MIPPUSH sets the destination IP address and destination port number for the current and future transactions. These values are used for the next push if not explicitly overwritten.

## Online Data Mode

The Online Data Mode (ODM) feature, allows the user to transfer raw data (without using the +MIPSEND and +MIPPUSH commands) between C24 and Network. The data transfers via established network connection (socket), based on internal TCP or UDP protocol stack. RS232 connection between C24 and terminal with Hardware flow control is required for the feature execution.

A special AT Command +MIPODM (instead of +MIPOPEN) is used to open a socket in Online Data Mode. The command provides a set of parameters for the feature configuration and corrects performance, see [“+MIPODM, Open a Socket \(UDP or TCP\) in Online Data Mode” on page 3-181](#). When a socket is successfully opened in Online Data Mode, all data, comes from terminal, "as is" is being sent to Network and vice versa: all data, comes from Network, "as is" is being sent to terminal.

Each socket, opened in Online Data Mode, allocates an accumulating buffer whose size is 1372 bytes. When the user sends amount of data, less then the buffer size, the data is being sent to Network after a spooling timeout (200 mS), otherwise the data is being sent to Network immediately.

When ODM feature is executed, pseudo-command mode is enabled in PREMUX state and disabled in MUX state by default (see RS232 Multiplexer Feature). ODM feature allows the user to disable pseudo-command mode, when C24 is in PREMUX state by setting "pseudo-command mode enable/disable" parameter to "1" - see [“+MIPODM, Open a Socket \(UDP or TCP\) in Online Data Mode” on page 3-181](#). Disabled pseudo-command mode provides better data transfer performance.

When C24 is in MUX state and ODM feature executed, a pseudo-command mode is not supported.

The user can suspend an opened in Online Data Mode socket by entering, for example, ESC sequence (by default "+++") from terminal, when pseudo-command mode is enabled. In this case C24 switches to pseudo-command mode, allowing the user to enter AT commands from terminal. The ATO command used to resume Online Data Mode from pseudo-command mode. When a data comes from Network and C24 is in pseudo-command mode, a special unsolicited event (+MIPDATA) is being sent to terminal (see [“+MIPDATA, Network Incoming Data Unsolicited Indication in Pseudo-command Mode” on page 3-184](#)).

When socket is in Online Data Mode (not in pseudo-command mode), RS232 communication DCD line is enabled.

There are two options to suspend a socket, opened in Online Data Mode, when C24 is in PREMUX state:

- Enter ESC sequence from terminal.
- Disable DTR line on RS232 communication port in case of AT&D1 parameter configuration.

There are two options for valid closing of a socket, opened in Online Data Mode, when C24 is in PREMUX state:

- Switch C24 to pseudo-command mode and enter +MIPCLOSE command with opened in Online Data Mode Socket ID.
- Disable DTR line on RS232 communication port in case of A&D2 or AT&D3 parameter configuration.

When C24 is in MUX state, change of DTR or software DTR state on ODM MUX channel closes ODM session in case of A&D1, A&D2 or AT&D3.

When an error occurred with the socket, opened in Online Data Mode, the socket closes automatically and +MIPSTAT unsolicited response is being sent to terminal (see [“+MIPSTAT, Status Report” on page 3-163](#)).

## SSL

### General Description

SSL (Secure Socket Layer) and its successor TLS (Transport Layer Security) are cryptographic protocols which provide endpoint authentication and communication privacy over the TCP / IP. There are slight differences between SSL 3.0 and TLS 1.0, but the protocol remains substantially the same. The term "SSL" as used here applies to both protocols unless clarified by context.

### Cipher Suite

Cipher Suite is a set of cryptographic algorithms. A cipher suite specifies one algorithm for each of the following tasks: Key exchange, Bulk encryption and Message authentication. For example, Cipher Suite TLS\_RSA\_WITH\_RC4\_128\_MD5 specifies RSA as key exchange algorithm, RC4 with key length 128 bit as a stream cipher algorithm, to encrypt data transfer after handshake, and MD5 as algorithm for SSL message authentication.

The C24 SSL feature supports the following Cipher Suites (listed in order of the preference):

- TLS\_RSA\_WITH\_3DES\_EDE\_CBC\_SHA
- TLS\_RSA\_WITH\_RC4\_128\_MD5
- TLS\_RSA\_WITH\_RC4\_128\_SHA
- TLS\_RSA\_EXPORT\_WITH\_RC4\_40\_MD5
- TLS\_DHE\_DSS\_WITH\_3DES\_EDE\_CBC\_SHA
- TLS\_RSA\_WITH\_NULL\_MD5

### Certificate expiration time

In order to check if SSL Certificate has expired, C24 uses internal clock. Some cellular operators support automatic time synchronization, so the C24 internal clock synchronizes automatically. In case the cellular operator does not support such feature, user should manually set C24 internal clock using +CCLK AT command. Since the clock is reset when the power to C24 is cut, the current time should be updated after C24 is powered up.

## Features and Benefits

The TCP/UDP IP feature provides the terminal with the following benefits:

- Up to four simultaneous protocol connections.
- Ability to pass data via the protocol stack using AT commands (command mode). This relieves the terminal from switching the RS232 to "binary mode" and back to "command mode".
- Ability to use UDP and TCP simultaneously.
- No need for protocol support from the terminal - only data sending and receiving.
- Reduced memory utilization. The C24 manages the protocol stack and therefore saves terminal memory.
- Ability to open TCP connections, secured with SSL/TLS.
- Ability to receive the incoming TCP connections.
- Ability to accept IP connections only if the IP belongs to a defined IP white list.

## FTP Connection

### Overview

C24 implements FTP connection feature, based on RFC959 standard, and operates as a FTP client. When connected to a remote FTP server, C24 is able to receive information about remote file system, manage it and perform files transfer operations.

### Manage FTP Connection

AT+FTPOPEN command is used to open a FTP connection with a remote FTP server. When C24 performs FTP connection establish procedure, it allocates two TCP sockets. One of them is used for FTP control channel, the other - for FTP data channel (listen mode). FTP control channel port has default identification number (ID) - 21 for source (client) and destination (server) sides, but the user is able to configure control channel port ID for client as well as for server by passing new source control port and/or new destination control port id as AT+FTPOPEN command optional parameters. This is applicable when a remote FTP server is able to accept FTP connection over non-standard (other than 21) ports. FTP data channel port has a default identification number (ID) - 20 for source (client) side, but the user is able to configure data channel port id by passing a new source data port id as AT+FTPOPEN command optional parameter. This is applicable when the remote FTP server is unable to establish data connection to some port IDs. The following example show how to use AT+FTPOPEN command in various situations.

- To open a FTP connection with a remote FTP server, use the following settings:

destination URL	= someftpsite.com	(mandatory)
user	= anonymous	(mandatory)
password	= qwerty@email.com	(mandatory)
account	= ""	(optional, default value)
source control port id	= 21	(optional, default value)
destination control port id	= 21	(optional, default value)
source data port id	= 20	(optional, default value)

AT+FTPOPEN = "someftpsite.com","anonymous","qwerty@somemail.com",,,,

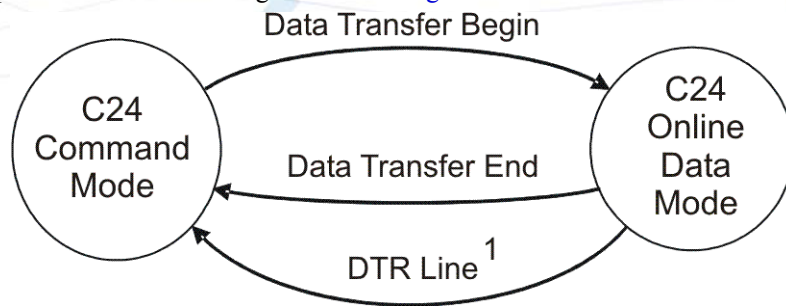
- To open a FTP connection with a remote FTP server, use the same mandatory settings, but customize source control and data ports id:

source control port id	= 1300	(optional, custom value)
destination control port id	= 21	(optional, default value)
source data port id	= 1302	(optional, custom value)

AT+FTPOPEN = "someftpsite.com","anonymous","qwerty@somemail.com",,1300,,1302

When FTP connection is establish, C24 remains in command mode. This mode is used for performing most of the FTP AT commands. Only AT+FTPLIST, AT+FTPSTOR and AT+FTPRETR commands switch C24 to online data mode. Generally, C24 returns to command mode after the data mode caused command execution is finished, but the user is able to interrupt online data mode (and close actual FTP connection) by changing the DTR line status from ON to OFF, when AT&D settings = 2 or 3.

The C24 operation modes switching is shown in Figure 1-2.



**Figure 1-2: C24 Operation Modes Switching**

**Note:** <sup>1</sup>AT&D settings = 2 or 3. The operation closes the actual FTP connection and switches C24 to command mode.  
AT&D settings = 1 does not affect.

Established FTP connection can be closed when C24 is in command mode by AT+FTPCLOSE command or by changing DTR line status from ON to OFF when data transfer operations are performed (C24 is in online data mode).

## Manage Remote File System

When FTP connection is established, the user is able to manage file system on the remote FTP server, like create, remove, change directory, rename or delete a file. The following FTP commands are used for remote file system management purpose.

- +FTPCWD - changes the working directory on a remote server.
- +FTPMKD - creates a new directory on a remote server.
- +FTPRMD - removes existing directory on a remote server.
- +FTPPWD - returns actual working directory name from a remote server.
- +FTPCDUP - changes working directory on a remote server, up to parent directory.
- +FTPDEL - deletes a file on a remote server.
- +FTPREN - renames a file on a remote server.

## File Transfer Operations

The file transfer operation allows the user to transfer a file over an established FTP connection. To avoid end-of-file detection problem for user in download case and for C24 in upload case, C24 implements a special format of transferred files over FTP connection. The format proposed "escaping" one of the ASCII symbols of a file context and using the "escaped" symbol as end-of-file marker. An escaping algorithm is described below.

The algorithm defines two special characters: EOF (end-of-file character) and ESC (escape character). EOF symbol is a hexadecimal 0x03 (decimal 3) ASCII ETX symbol and ESC symbol is a hexadecimal 0x10 (decimal 16) ASCII DLE symbol - not to be confused with the ASCII ESCape character.

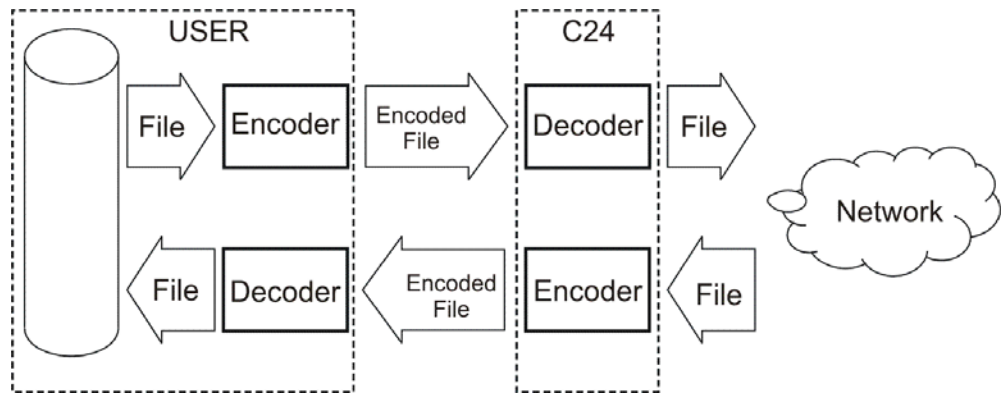
To encode a file to FTP File Transfer Format, the user or C24 will read each data byte from the source file and will perform the following operations:

- When a data byte has the same code as EOF character, a two byte sequence of ESC and EOF characters is sent instead.
- When a data byte has the same code as ESC character, a two byte sequence of ESC and ESC characters is sent instead.
- When end of file is reached, EOF character is sent.

To decode a file from FTP File Transfer Format, the user or C24 will read each data byte from the source file and will perform the following operations:

- When a data byte has the same code as ESC character and next data byte is ESC or EOF character, the first byte should be ignored.
- When a data byte has the same code as EOF character and previous data byte is not ESC character, end of file is reached.

The process is illustrated in [Figure 1-3](#).



**Figure 1-3: Files Transfer Process**

## Other FTP Operations

C24 provides +FTPINFO feature that allows the user to receive more information about FTP connection and FTP commands execution. When the feature is enabled, all FTP commands send by C24 to the remote server and all FTP responses, received by the C24 from the remote server are printed to the user as AT+FTPINFO: <text> unsolicited response. Use the AT+FTPINFO=1 for the feature enabling, and the AT+FTPINFO=0 for the feature disabling in any C24 operation time, when C24 is in command mode.

## Interaction with Other MIP Commands

### Interaction with +MIPODM Command

The external ODM session is prohibited when FTP feature is executed, because FTP feature data connection is based on socket, opened for ODM (internal ODM session), so, when C24 receives +MIPODM command within FTP connection, the error code: 302 (FTP session is active) is returned to the user.

### Interaction with +MIPOPEN and +MIPCLOSE Commands

The user cannot initiate FTP connection with +MIPOPEN command as well as close FTP connection with +MIPCLOSE command. However, +MIPOPEN and +MIPCLOSE commands in "read" state still indicate actually used / unused sockets include sockets, allocated for active FTP connection:

- AT+MIPOPEN? indicates inactive sockets (include allocated for active FTP connection)
- AT+MIPCLOSE? indicates active sockets (include allocated for active FTP connection)

When C24 receives +MIPCLOSE command for closing a socket, used within FTP connection, the error code: 302 (FTP session is active) is returned to the user.

## Audio

### Overview

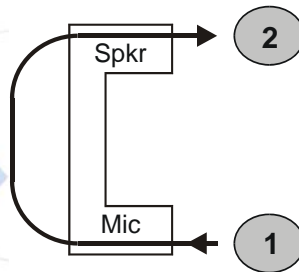
The audio (digital and analog) feature in the C24 module involves three main issues: path (routes the current input and output devices), gain (volume management) and algorithm. For more information, refer to [“Audio” on page 3-298](#).

### Features and Benefits

The following algorithm related features are provided:

#### Sidetone

Sidetone reduces the microphone audio input that is routed to the selected speaker so that the person speaking can hear himself or herself talking. This creates a slight echo because the speaker sound then gets picked up again by the microphone and is again routed to the speaker, and so on. Echo suppress is designed to take care of this echo.



**Figure 1-4: Sidetone**



## Echo Suppression

Echo suppression suppresses a large amount of the output sound picked up by the input device (cancels all echoes).

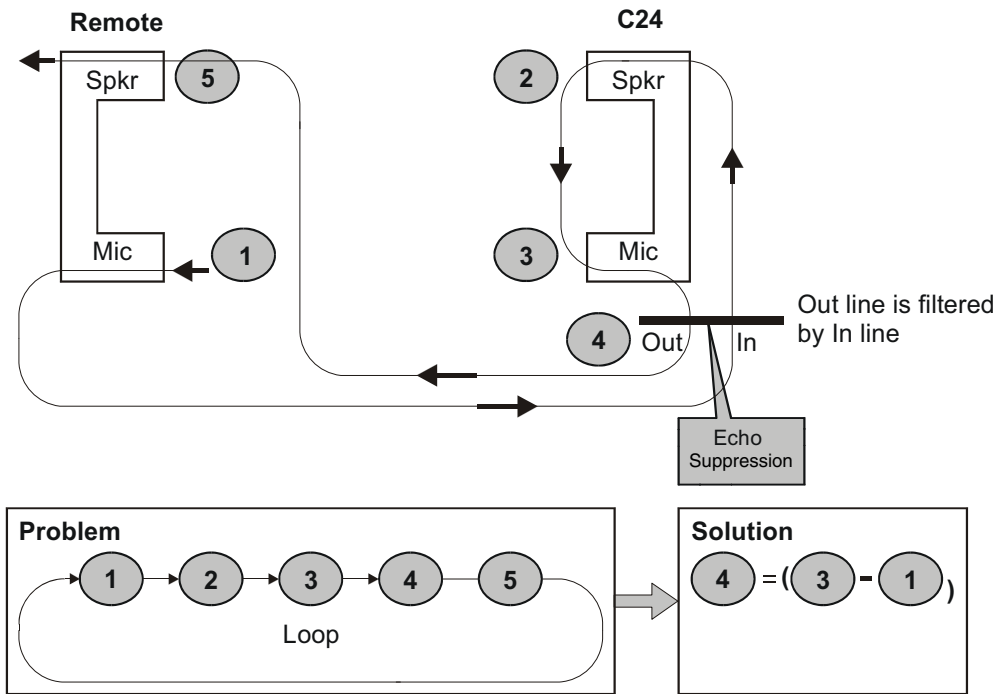


Figure 1-5: Echo Suppression

## Noise Suppress

Noise suppression improves audio quality in all modes by suppressing environment noise from being picked up by the input device.

## Technical Description

The path features provide full control over the navigation of the audio in the product.

The gain features provide full control over the volume levels of the different output accessories and tones.

The algorithm provides full control over activation/deactivation of audio quality features such as echo canceling and noise suppression.

The user can access these features by means of AT commands. These are described later in this document.

## MUX Integration

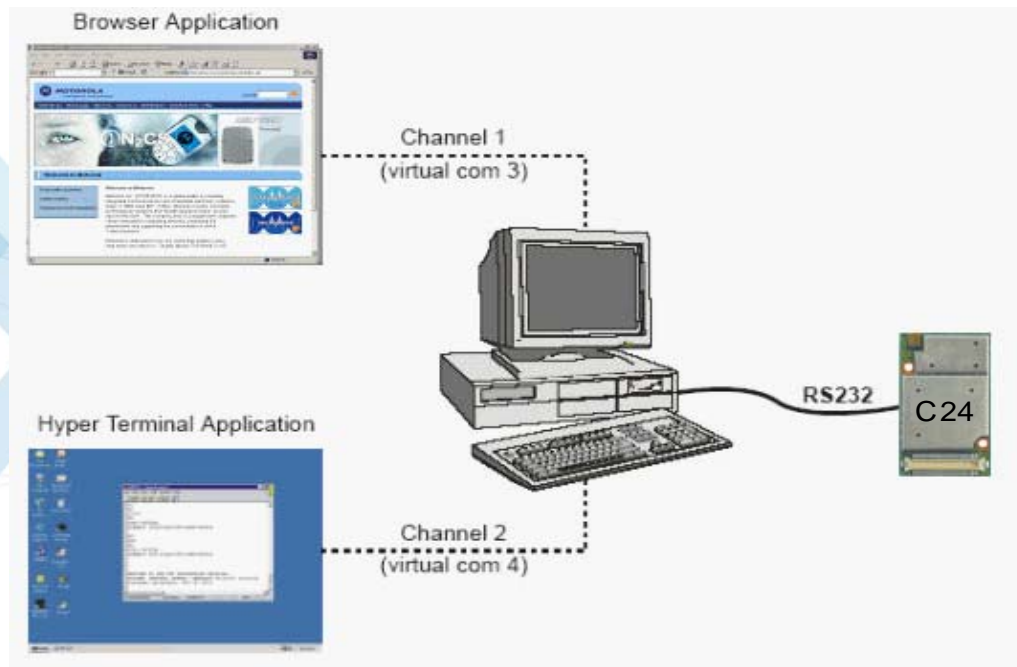
### Overview

The C24 is supplied with an internal 3GPP 27.10 protocol stack, also referred to as a multiplexer or MUX.

The C24 with multiplexer support utility provides the following capabilities:

- Provides the terminal with up to five virtual channels on one physical RS-232 connection.
- Provides simultaneous data (CSD/1x data call) and command (AT command set) services. In this way, many applications can use a single RS232 line via virtual channels. This enables a user to make network and phone service inquiries and maintain data communication at the same time.

These capabilities are illustrated in the following figure:



**Figure 1-6: C24 with Multiplexer Support Capabilities**

### Features and Benefits

The C24 with the MUX feature ENABLES multiple channel operation and simultaneous data and control operation. For example, it allows a user to be connected to an Internet website (1x data session connected), receive a file via CSD Call, and query the C24 phone book all at the same time.

The following actions are enabled during a data session:

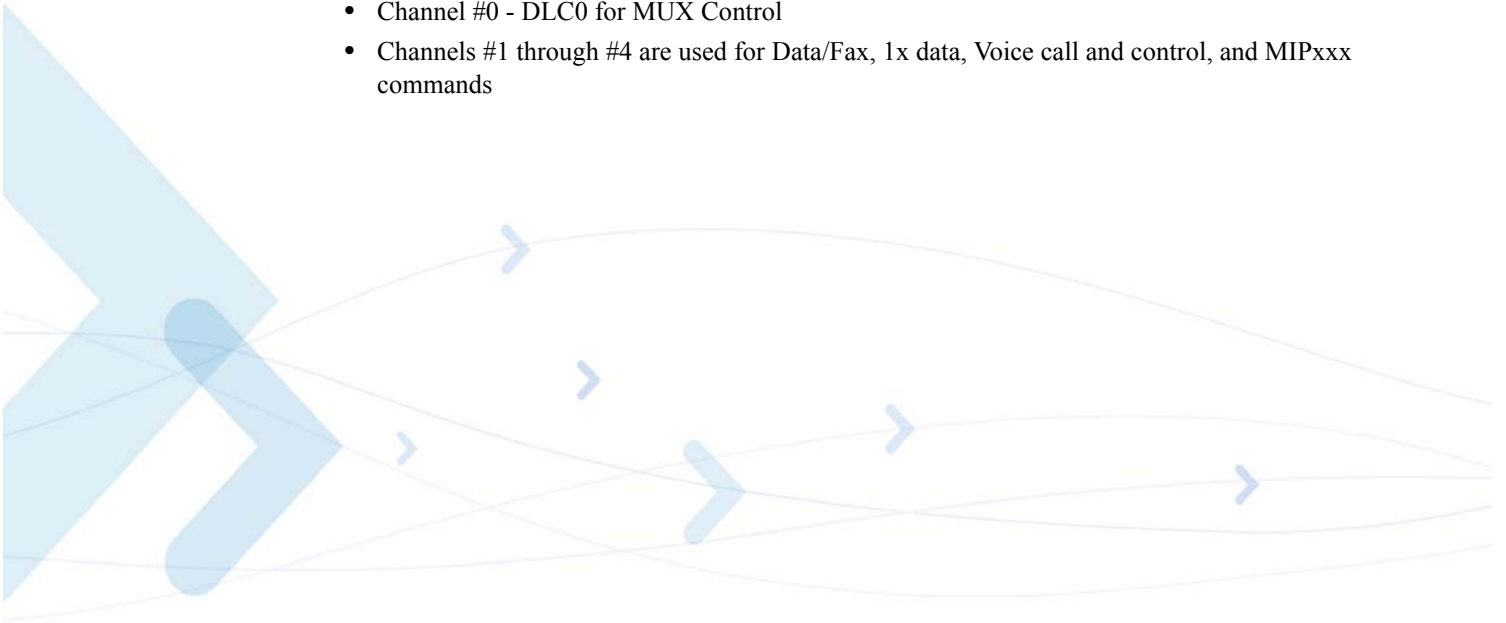
- Incoming call alert string RING (while C24 is in 1x data session)
- Answering to incoming call via the ATA command (while C24 is in 1x data session)

- Receive Incoming SMS indication
- Inquiry CDMA coverage indication
- Setup a voice call (while C24 is in 1x data session)
- Send & Receive SMS
- Read/write to/from Phone Book
- Local modem operation
- Network interrogation and settings

## Technical Description

The MUX feature adds five virtual channels on a single physical RS232 line:

- Channel #0 - DLC0 for MUX Control
- Channels #1 through #4 are used for Data/Fax, 1x data, Voice call and control, and MIPxxx commands



## Short Message Service (SMS)

### Overview

The SMS feature provides means for SMS messages handling and the reporting of SMS reception events.

C24 SMS implementation is based on the 3GPP 23.040 specification.

### Features

The SMS, as defined within the GSM 800/1900 digital mobile phone standard:

- A single short message can be up to 160 characters of ASCII text in length (7-bit coded). Message text can comprise words, numbers or an alphanumeric combination.
- Short messages can be written and displayed in various coding schemes, including ASCII and UCS2.
- Reception of an incoming message can invoke an indication to the terminal. This feature is configurable using the command AT+CNMI.
- Short messages can be sent and received simultaneously with CDMA voice.
- Cell broadcast messages can also be selected and received on the C24. The C24 enables registration to specific broadcast channels.

## Technical Description

A new incoming message is saved in the first free memory location, from index 251.

The C24 memory can contain up to 250 outgoing and CB messages. A new outgoing message is saved in the next free memory location, from index 1 up to index 200.

SMS Type	SMS Index	Max Number of SMS
Incoming messages	251	R-UIM-dependent (if supported)
	252	
	...	
	350	
Outgoing messages	1	200
	2	
	...	
	200	
CB messages	201	50
	250	

## Fax

### Overview

C24 supports Service Class 2.0.

### Features and Benefits

Sending and receiving Fax services.



## Character Sets

The following includes the references to various tables that provide conversions between the different character sets.

- CS1 - GSM to UCS2.
- CS2 - ASCII to/from UTF8.
- CS3 - UCS2 to/from UTF8.

For the full content of a specific conversion table, refer to Appendix A, Character Set Tables.

### ASCII Character Set Management

The ASCII character set is a standard seven-bit code that was proposed by ANSI in 1963, and finalized in 1968. ASCII was established to achieve compatibility between various types of data processing equipment.

### GSM Character Set Management

In C24, the GSM character set is defined as octant stream. This means that text is displayed not as GSM characters but in the hex values of these characters.

### UCS2 Character Set Management

UCS2 is the first officially standardized coded character set, eventually to include the characters of all the written languages in the world, as well as all mathematical and other symbols.

Unicode can be characterized as the (restricted) 2-octet form of UCS2 on (the most general) implementation level 3, with the addition of a more precise specification of the bi-directional behavior of characters, as used in the Arabic and Hebrew scripts.

The 65,536 positions in the 2-octet form of UCS2 are divided into 256 rows with 256 cells in each. The first octet of a character representation denotes the row number, the second the cell number. The first row (row 0) contains exactly the same characters as ISO/IEC 8859-1. The first 128 characters are thus the ASCII characters. The octet representing an ISO/IEC 8859-1 character is easily transformed to the representation in UCS2 by placing a 0 octet in front of it. UCS2 includes the same control characters as ISO/IEC 8859 (also in row 0).

### UTF-8 Character Set Management

UTF-8 provides compact, efficient Unicode encoding. The encoding distributes a Unicode code value's bit pattern across one, two, three, or even four bytes. This encoding is a multi-byte encoding.

UTF-8 encodes ASCII in a single byte, meaning that languages using Latin-based scripts can be represented with only 1.1 bytes per character on average.

UTF-8 is useful for legacy systems that want Unicode support because developers do not have to drastically modify text processing code. Code that assumes single-byte code units typically does not fail completely when provided UTF-8 text instead of ASCII or even Latin-1.



Unlike some legacy encoding, UTF-8 is easy to parse. So-called lead and trail bytes are easily distinguished. Moving forwards or backwards in a text string is easier in UTF-8 than in many other multi-byte encoding.

The codes in the first half of the first row in Character Set Table CS2 (UTF-8 <-> ASCII) are replaced in this transformation format by their ASCII codes, which are octets in the range between 00h and 7F. The other UCS2 codes are transformed to between two and six octets in the range between 80h and FF. Text containing only characters in Character Set Table CS3 (UTF-8 <-> UCS-2) is transformed to the same octet sequence, irrespective of whether it was coded with UCS-2.

## 8859-1 Character Set Management

ISO-8859-1 is an 8 bit character set - a major improvement over the plain 7 bit US-ASCII.

Characters 0 to 127 are always identical with US-ASCII and the positions 128 to 159 hold some less used control characters. Positions 160 to 255 hold language-specific characters.

ISO-8859-1 covers most West European languages, such as French (fr), Spanish (es), Catalan (ca), Basque (eu), Portuguese (pt), Italian (it), Albanian (sq), Rhaeto-Romanic (rm), Dutch (nl), German (de), Danish (da), Swedish (sv), Norwegian (no), Finnish (fi), Faroese (fo), Icelandic (is), Irish (ga), Scottish (gd) and English (en). Afrikaans (af) and Swahili (sw) are also included, extending coverage to much of Africa.

## AT Commands Summary

The following list contains a summary of all the C24 AT commands sorted by functionality.

**Table 1-1: AT Commands**

AT Command	Description	Page
<b>Modem ID</b>		
<b>Subscriber Unit Identity</b>		
<b>+CGMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-1</a>
<b>+GMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-1</a>
<b>+FMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-1</a>
<b>+CGMM</b>	This command displays the model identification.	<a href="#">Page 3-2</a>
<b>+GMM</b>	This command displays the model identification.	<a href="#">Page 3-2</a>
<b>+FMM</b>	This command displays the model identification.	<a href="#">Page 3-2</a>
<b>+CGMR</b>	This command displays the revision identification.	<a href="#">Page 3-3</a>
<b>+GMR</b>	This command displays the revision identification.	<a href="#">Page 3-3</a>
<b>+FMR</b>	This command displays the revision identification.	<a href="#">Page 3-3</a>
<b>+CGSN</b>	This command displays the product serial number identification in decimal format.	<a href="#">Page 3-3</a>
<b>+GSN</b>	This command displays the product serial number identification in Hex format.	<a href="#">Page 3-3</a>
<b>+MPESND</b>	Requests Pseudo Electronic Serial Number Identification in Decimal.	<a href="#">Page 3-4</a>
<b>+MPESNH</b>	Requests Pseudo Electronic Serial Number Identification in Hex.	<a href="#">Page 3-5</a>
<b>+UMID</b>	This command returns the User Identification Module Identifier (UIMID) of the R-UIM.	<a href="#">Page 3-5</a>
<b>+CSCS</b>	This command selects the C24 character set.	<a href="#">Page 3-5</a>
<b>+CIMI</b>	This command displays the International Mobile Subscriber Identity number.	<a href="#">Page 3-7</a>
<b>+CFSN</b>	This command displays the factory serial number.	<a href="#">Page 3-7</a>
<b>I</b>	This command displays various C24 information items.	<a href="#">Page 3-7</a>
<b>\$</b>	This command displays a list of all the AT commands supported by the C24.	<a href="#">Page 3-8</a>
<b>+CLAC</b>	This command displays a list of all the AT commands supported by the C24.	<a href="#">Page 3-9</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>Call Control</b>		
<b>Call Control Commands</b>		
<b>D</b>	This command places a voice call on the current network, when issued from an accessory device.	<a href="#">Page 3-12</a>
<b>D&gt;</b>	This command places a voice/fax/data call on the current network by dialing directly from the C24 phone book.	<a href="#">Page 3-13</a>
<b>DL</b>	This command places a voice call to the last number dialed.	<a href="#">Page 3-15</a>
<b>H</b>	This command hangs up, or terminates a data call.	<a href="#">Page 3-16</a>
<b>A</b>	This command answers an incoming call, placing the C24 into the appropriate mode, as indicated by the RING message.	<a href="#">Page 3-17</a>
<b>+MARS</b>	This command enables the C24 to report when auto redial starts or ends, when enabled.	<a href="#">Page 3-18</a>
<b>+MARD</b>	This command enables and disables the auto-redial capability of the C24.	<a href="#">Page 3-18</a>
<b>\$QCCAV</b>	This command answers an incoming voice call.	<a href="#">Page 3-19</a>
<b>+CHV</b>	This command hangs-up a voice call.	<a href="#">Page 3-20</a>
<b>+CDV</b>	This command dials voice calls.	<a href="#">Page 3-20</a>
<b>+CRC</b>	This command controls whether to present the extended format of the incoming call indication.	<a href="#">Page 3-20</a>
<b>RING</b>	This unsolicited event is received when an incoming call (voice, data or fax) is indicated by the cellular network.	<a href="#">Page 3-20</a>
<b>+CRING</b>	This unsolicited event indicates the type of incoming call.	<a href="#">Page 3-20</a>
<b>O</b>	This command returns the C24 from the Command mode to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	<a href="#">Page 3-22</a>
<b>+COLP</b>	This command gets and changes the current setting of the Calling Line Presentation.	<a href="#">Page 3-23</a>
<b>+CSO</b>	This command specifies the preferred service to be requested for the next originated packet call.	<a href="#">Page 3-24</a>
<b>+MDC</b>	This AT command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	<a href="#">Page 3-24</a>
<b>+MFIC</b>	This command instructs the C24 to query or set Filtering Incoming Calls parameters.	<a href="#">Page 3-25</a>
<b>+MFOC</b>	This command instructs the C24 to query or set Filtering Outgoing Calls parameters.	<a href="#">Page 3-27</a>
<b>Supplementary services</b>		
<b>+MAIF</b>	This command allows the user to manage supplementary services by sending an air interface Flash.	<a href="#">Page 3-28</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>+CLIP</b>	This command controls the Calling Line Identity (CLI) presentation to the terminal when there is an incoming call.	<a href="#">Page 3-28</a>
<b>+CCWA</b>	This command controls the Call Waiting supplementary service, including settings and querying of the network by the C24.	<a href="#">Page 3-30</a>
<b>+CLIR</b>	This command enables/disables the sending of caller ID information to the called party, for an outgoing call.	<a href="#">Page 3-36</a>
<b>Call Status Messages</b>		
<b>+CPAS</b>	This command displays the current activity status of the C24, for example, call in progress, or ringing.	<a href="#">Page 3-38</a>
<b>+CLCC</b>	This command displays a list of all current C24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	<a href="#">Page 3-39</a>
<b>+MCST</b>	This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.	<a href="#">Page 3-42</a>
<b>+MVPRI</b>	This command sets the voice privacy.	<a href="#">Page 3-44</a>
<b>+MECALL</b>	This unsolicited report sends indication of an emergency call to the terminal.	<a href="#">Page 3-44</a>
<b>SMS</b>		
<b>SMS Commands</b>		
<b>+CSMS</b>	This command handles the selection of the SMS message service type.	<a href="#">Page 3-53</a>
<b>+CPMS</b>	This command handles the selection of the preferred storage area for messages.	<a href="#">Page 3-54</a>
<b>+CMGF</b>	This command handles the selection of message formats.	<a href="#">Page 3-57</a>
<b>+CSDH</b>	This command shows the Text Mode parameters.	<a href="#">Page 3-58</a>
<b>+CSMP</b>	This command sets the Text Module parameters.	<a href="#">Page 3-60</a>
<b>+CNMI</b>	This command sends an unsolicited indication when a new SMS message is received by the C24.	<a href="#">Page 3-62</a>
<b>+CMTI</b>	This unsolicited message, including the SMS message index, is sent upon the arrival of an SMS message.	<a href="#">Page 3-64</a>
<b>+CMT</b>	This unsolicited message forwards the SMS upon its arrival.	<a href="#">Page 3-66</a>
<b>+CNMA</b>	This command acknowledges the receipt of a +CMT response.	<a href="#">Page 3-66</a>
<b>+CDS</b>	This unsolicited response is sent to the TE upon receipt of a new SM.	<a href="#">Page 3-67</a>
<b>+CMGL</b>	This command displays a list of SMS messages stored in the C24 memory.	<a href="#">Page 3-68</a>
<b>+MMGL</b>	This command displays a list of SMS messages stored in the C24 memory.	<a href="#">Page 3-68</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>+CMGR</b>	This command reads selected SMS messages from the C24 memory.	<a href="#">Page 3-73</a>
<b>+MMGR</b>	This command reads selected SMS messages from the C24 memory.	<a href="#">Page 3-73</a>
<b>+MMAR</b>	This command changes the status of an SMS message in the C24 memory from "REC UNREAD" to "REC READ".	<a href="#">Page 3-77</a>
<b>+CMGW</b>	This command writes and saves messages in the C24 memory.	<a href="#">Page 3-78</a>
<b>+CMSS</b>	This command selects and sends pre-stored messages from the message storage.	<a href="#">Page 3-79</a>
<b>+CMGD</b>	This command deletes messages from the C24 memory.	<a href="#">Page 3-81</a>
<b>+CMGS</b>	This command sends an SM from the C24 to the network.	<a href="#">Page 3-82</a>
<b>Network</b>		
<b>Network Service Commands</b>		
<b>+CREG</b>	This command enables/disables the network status registration unsolicited result code.	<a href="#">Page 3-88</a>
<b>+CSQ</b>	This command displays the signal strength received by the C24.	<a href="#">Page 3-89</a>
<b>+MSSI</b>	This command enables/disables the unsolicited report for signal strength value.	<a href="#">Page 3-90</a>
<b>Network Parameters Commands</b>		
<b>+NETPAR</b>	This command displays information regarding the active, candidate, and neighbor cell.	<a href="#">Page 3-91</a>
<b>+MDISP</b>	This command is used to display characters that the network sends to the module.	<a href="#">Page 3-92</a>
<b>+MDORMANT</b>	This command enable/disable the dormant indication unsolicited report.	<a href="#">Page 3-93</a>
<b>+MPREFMODE</b>	This command configures System Select setting.	<a href="#">Page 3-94</a>
<b>+MBAND</b>	This command selects Preferred Band.	<a href="#">Page 3-94</a>
<b>User Interface</b>		
<b>+CLAN</b>	This command handles the selection of language in the ME.	<a href="#">Page 3-96</a>
<b>+CMER</b>	Mobile Equipment Event Reporting.	<a href="#">Page 3-97</a>
<b>+CIEV</b>	An unsolicited indication regarding various phone indications that is sent to the DTE when the <ind> parameter of the +CMER command is set to 1.	<a href="#">Page 3-98</a>
<b>+MMR</b>	This command perform master reset.	<a href="#">Page 3-99</a>
<b>+MMRR</b>	This unsolicited message is sent to the DTE by the C24 if a master reset occurs, and master reset events reporting is enabled.	<a href="#">Page 3-100</a>
<b>+CIND</b>	This command is used to query the status of various ME indicators.	<a href="#">Page 3-101</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>Access</b>		
<b>+MPIN</b>	This command enables the accessory application to unlock the phone when the appropriate unlock code has been provided.	<a href="#">Page 3-103</a>
<b>A/</b>	This command repeats the last command entered on the terminal.	<a href="#">Page 3-104</a>
<b>AT</b>	This command checks the AT communication and only returns OK.	<a href="#">Page 3-104</a>
<b>+CPIN</b>	This command unlocks the R-UIM card when the proper R-UIM PIN is provided and unblocks the R-UIM card when the proper R-UIM PUK is provided.	<a href="#">Page 3-104</a>
<b>+EPIN</b>	This AT command will be used to verify the PIN2 when the proper R-UIM PIN2 password has been provided.	<a href="#">Page 3-107</a>
<b>+TPIN</b>	This command returns the number of remaining attempts of entering the PIN and PUK for the R-UIM card in use.	<a href="#">Page 3-108</a>
<b>+CPWD</b>	This command sets a new password for the facility lock.	<a href="#">Page 3-109</a>
<b>+CLCK</b>	This command locks, unlocks or interrogates a C24 or a network facility <fac>.	<a href="#">Page 3-111</a>
<b>+MMRU</b>	This command provides limited access to the Elementary Files on the R-UIM.	<a href="#">Page 3-113</a>
<b>Phone Books and Clock</b>		
<b>Directory Access Commands - Phone Book</b>		
<b>+CPBS</b>	This command handles the selection of the memory to be used for reading and writing entries in C24s that contain more than one phone book memory.	<a href="#">Page 3-118</a>
<b>+CPBR</b>	This command recalls phone book entries from a specific entry number, or from a range of entries.	<a href="#">Page 3-120</a>
<b>+CPBF</b>	This command searches the currently active phone book for a particular entry, by name.	<a href="#">Page 3-121</a>
<b>+CPBW</b>	This command stores a new entry in the phone book, or deletes an existing entry from the phone book.	<a href="#">Page 3-122</a>
<b>+CSVM</b>	This command handles the selection of the number to the voice mail server.	<a href="#">Page 3-124</a>
<b>System Date and Time Access Commands</b>		
<b>+CCLK</b>	This command reads/sets the C24's current date and time settings.	<a href="#">Page 3-125</a>
<b>Facsimile Service Class 2.0</b>		
<b>+FCLASS</b>	This command places the terminal in particular mode of operation (data, fax, voice).	<a href="#">Page 3-128</a>
<b>Hardware Information</b>		
<b>Hardware Information Commands</b>		
<b>+GCAP</b>	This command displays the overall capabilities of the C24.	<a href="#">Page 3-132</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>&amp;C</b>	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	<a href="#">Page 3-132</a>
<b>&amp;D</b>	This command determines how the C24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	<a href="#">Page 3-134</a>
<b>+CBC</b>	This command queries the battery charger connection.	<a href="#">Page 3-135</a>
<b>+CBAUD</b>	This command sets the baud rate on the current UART.	<a href="#">Page 3-136</a>
<b>+IPR</b>	This command is responsible for setting and saving the request baud rate per UART	<a href="#">Page 3-138</a>
<b>&amp;K</b>	This command configures the flow control.	<a href="#">Page 3-139</a>
<b>+CFUN</b>	This command shuts down the phone functionality.	<a href="#">Page 3-141</a>
<b>S97</b>	This command indicates whether an antenna is physically connected to the C24 RF connector.	<a href="#">Page 3-142</a>
<b>+MRST</b>	This command enables customer software to perform a hard reset to the C24 unit.	<a href="#">Page 3-143</a>
<b>+MIOC</b>	This command defines the C24 8 GPIO pins data value.	<a href="#">Page 3-143</a>
<b>+MIOD</b>	This command defines the C24 8 GPIO pins configuration.	<a href="#">Page 3-146</a>
<b>+MMAD</b>	This command reads and monitors digital value from a specified ADC.	<a href="#">Page 3-148</a>
<b>TCP/IP</b>		
<b>+MIPCALL</b>	This command creates a wireless PPP connection with the GGSN or CSD service provider and returns a valid dynamic IP for the C24.	<a href="#">Page 3-153</a>
<b>+MIPOPEN</b>	This command causes the C24 module to initialize a new socket and open a connection with a remote side.	<a href="#">Page 3-154</a>
<b>+MIPCLOSE</b>	This command causes the C24 module to free the socket accumulating buffer and disconnect the C24 from a remote side.	<a href="#">Page 3-156</a>
<b>+MIPSETS</b>	This command causes the C24 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.	<a href="#">Page 3-157</a>
<b>+MIPSEND</b>	This command causes the C24 to transmit the data that the terminal provides, using an existing protocol stack.	<a href="#">Page 3-159</a>
<b>+MIPPUSH</b>	This command causes the C24 module to push the data accumulated in its accumulating buffers into the protocol stack.	<a href="#">Page 3-160</a>
<b>+MIPFLUSH</b>	This command causes the C24 module to flush (delete) data accumulated in its accumulating buffers.	<a href="#">Page 3-161</a>
<b>+MIPRUDP</b>	This unsolicited event is sent to the terminal when data is received from the UDP protocol stack.	<a href="#">Page 3-162</a>
<b>+MIPRTCP</b>	This unsolicited event is sent to the terminal when data is received from the TCP protocol stack.	<a href="#">Page 3-162</a>



**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>+MIPSTAT</b>	This unsolicited event is sent to the terminal indicating a change in link status.	<a href="#">Page 3-163</a>
<b>+MIPXOFF</b>	This unsolicited event is sent to the terminal to stop sending data.	<a href="#">Page 3-164</a>
<b>+MIPXON</b>	This unsolicited event is sent to the terminal when the C24 has free memory in the accumulating buffer.	<a href="#">Page 3-164</a>
<b>+MIPCONF</b>	This command allows configuring of TCP stack parameters.	<a href="#">Page 3-165</a>
<b>+MPING</b>	This command will allow verifying IP connectivity to another remote machine (computer) by sending one or more Internet Control Message Protocol (ICMP) Echo Request messages.	<a href="#">Page 3-167</a>
<b>+MPINGSTAT</b>	This is the unsolicited response that the C24 sends to the terminal to inform of ping execution status update and provides summary statistics of ping request when ping request execution is completed.	<a href="#">Page 3-171</a>
<b>+MSDNS</b>	This command set/read DNS IP address.	<a href="#">Page 3-174</a>
<b>+MIPCFF</b>	This command allows configuring the incoming TCP connection filtering feature parameters, such as list of allowed IP addresses or disabling/enabling the filtering.	<a href="#">Page 3-175</a>
<b>+MIPSSL</b>	This unsolicited event is sent to the terminal indicating an errors, warnings or alerts that occurred during SSL connection.	<a href="#">Page 3-179</a>
<b>+MIPODM</b>	This command causes the C24 module to initialize a new socket in Online Data Mode and open a connection with a remote side.	<a href="#">Page 3-181</a>
<b>+MIPDATA</b>	This unsolicited event is sent to the terminal indicating a data comes from Network when C24 is in pseudo-command mode.	<a href="#">Page 3-184</a>
<b>+MIPCSC</b>	This AT command is used to configure the SSL feature behavior in case of non - fatal alerts.	<a href="#">Page 3-185</a>
<b>\$QCPREV</b>	This command returns the protocol revision in use.	<a href="#">Page 3-188</a>
<b>FTP (File Transfer Protocol)</b>		
<b>Session Commands</b>		
<b>+FTPOPEN</b>	This command causes C24 to open a FTP connection with a remote FTP server, based on given parameters.	<a href="#">Page 3-192</a>
<b>+FTPCLOSE</b>	This command causes C24 to close FTP connection, when no data transfer occurred at that same time.	<a href="#">Page 3-194</a>
<b>+FTPINFO</b>	This command causes the C24 to enable or disable FTP unsolicited indication to the user.	<a href="#">Page 3-195</a>
<b>+FTPSTAT</b>	This command causes the C24 to request the remote FTP server to send status, in accordance to a given parameter.	<a href="#">Page 3-197</a>
<b>+FTPSYST</b>	This command causes the C24 to request the remote FTP server to send the operating system type.	<a href="#">Page 3-199</a>
<b>+FTPNOOP</b>	This command causes the C24 to request the remote FTP server to do nothing.	<a href="#">Page 3-199</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>+FTPCWD</b>	This command causes the C24 to request the remote FTP server to change the working directory in accordance to a given name.	<a href="#">Page 3-200</a>
<b>+FTPMKD</b>	This command causes the C24 to request the remote FTP server to create a new directory in accordance to a given name.	<a href="#">Page 3-201</a>
<b>+FTP RMD</b>	This command causes the C24 to request the remote FTP server to remove a directory in accordance to a given name.	<a href="#">Page 3-202</a>
<b>+FTPPWD</b>	This command causes C24 to request the remote FTP server to return the working directory name.	<a href="#">Page 3-204</a>
<b>+FTPCDUP</b>	This command causes the C24 to request the remote FTP server to change the working directory up.	<a href="#">Page 3-204</a>
<b>+FTPDEL</b>	This command causes the C24 to request the remote FTP server to delete a file, in accordance to a given name.	<a href="#">Page 3-205</a>
<b>+FTPLIST</b>	This command causes the C24 to request the remote FTP server to send a list, in accordance to a given parameter.	<a href="#">Page 3-206</a>
<b>+FTPTYPE</b>	This command represents the file supported by the C24.	<a href="#">Page 3-207</a>
<b>+FTPSTOR</b>	This command causes the C24 to request the remote FTP server to store a file, sent by the C24.	<a href="#">Page 3-208</a>
<b>+FTPRETR</b>	This command causes the C24 to request the remote FTP server to send a file to the C24.	<a href="#">Page 3-209</a>
<b>+FTPREN</b>	This command causes the C24 to request the remote FTP server to rename a file, in accordance to given parameters.	<a href="#">Page 3-210</a>
<b>Modem Configuration and Profile</b>		
<b>Modem Register Commands</b>		
<b>V</b>	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	<a href="#">Page 3-212</a>
<b>Q</b>	This command determines whether to output/suppress the result codes.	<a href="#">Page 3-213</a>
<b>E</b>	This command defines whether the C24 echoes the characters received from the user, (whether input characters are echoed to output).	<a href="#">Page 3-214</a>
<b>X</b>	This command defines the data adaptor response set, and the CONNECT result code format.	<a href="#">Page 3-215</a>
<b>Sn</b>	This command reads/writes values of the S-registers.	<a href="#">Page 3-216</a>
<b>S2</b>	This command handles the selection of the escape characters.	<a href="#">Page 3-218</a>
<b>\S</b>	This command displays the status of selected commands and S-registers.	<a href="#">Page 3-218</a>
<b>?</b>	This command displays the most recently updated value stored in the S-register.	<a href="#">Page 3-218</a>
<b>&amp;F</b>	This command restores the factory default configuration profile.	<a href="#">Page 3-219</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>Z</b>	This command resets the default configuration.	<a href="#">Page 3-220</a>
<b>&amp;V</b>	This command displays the current active configuration and stored user profiles.	<a href="#">Page 3-221</a>
<b>&amp;W</b>	This command stores the current active configuration to user profile 0 or 1.	<a href="#">Page 3-221</a>
<b>&amp;Y</b>	This command selects power-up configuration to user's profile.	<a href="#">Page 3-223</a>
<b>Sleep Mode Commands</b>		
<b>S24</b>	This command activates/disables the Sleep mode.	<a href="#">Page 3-226</a>
<b>S102</b>	This S-register sets the value of the delay before sending the data to the terminal.	<a href="#">Page 3-227</a>
<b>S100</b>	This command is a terminal minimum time limit for entering sleep mode.	<a href="#">Page 3-228</a>
<b>+MSCTS</b>	This command defines the behavior of the CTS line when the C24 is in normal mode (not Sleep mode).	<a href="#">Page 3-229</a>
<b>NAM Programming</b>		
<b>+MNAME</b>	This command gets or sets the NAM parameters (parameters 1-12 out of 35).	<a href="#">Page 3-231</a>
<b>+MNAME2</b>	This command gets or sets the NAM parameters (parameters 13-22 out of 35).	<a href="#">Page 3-233</a>
<b>+MNAME3</b>	This command gets or sets the NAM parameters (parameters 23-35 out of 35).	<a href="#">Page 3-235</a>
<b>+SNAM</b>	This command Selects/reads the current active NAM to which the NAM data will be written/retrieved using AT+MNAME [x].	<a href="#">Page 3-238</a>
<b>PRL Commands</b>		
<b>+CPRL1</b>	This command set/get the PRL header parameters.	<a href="#">Page 3-241</a>
<b>+CPRL2</b>	This command enables the user to control the PRL acquisition table.	<a href="#">Page 3-243</a>
<b>+CPRL3</b>	This command enables the user to control the PRL System table.	<a href="#">Page 3-246</a>
<b>+CPRL4</b>	This command uploads an entire PRL file.	<a href="#">Page 3-249</a>
<b>PRI Commands</b>		
<b>+MPRISUM</b>	This command return the PRI checksum.	<a href="#">Page 3-250</a>
<b>Error Handling Commands</b>		
<b>+CMEE</b>	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the C24.	<a href="#">Page 3-250</a>
<b>+CEER</b>	This command returns an extended error report containing one or more lines of information text, determined by the manufacturer, providing the reasons for the call-clearing errors.	<a href="#">Page 3-254</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>+MSPC</b>	This unsolicited message displays an error report in case the network set incorrect password for more times than permitted.	<a href="#">Page 3-257</a>
<b>Re-Flash Mode</b>		
<b>+MREFLASH</b>	Enter to Re-Flash Mode.	<a href="#">Page 3-257</a>
<b>Mobile IP Configuration</b>		
<b>\$QCMIPNAI</b>	This command sets the NAI for the currently active profile.	<a href="#">Page 3-258</a>
<b>\$QCMIPPHA</b>	This command sets the primary HA IP for the currently active profile.	<a href="#">Page 3-259</a>
<b>\$QCMIPSHA</b>	This command sets the secondary HA IP for the currently active profile.	<a href="#">Page 3-260</a>
<b>\$QCMIPHA</b>	This command sets the HA IP for the currently active profile.	<a href="#">Page 3-260</a>
<b>\$QCMIPMHSS</b>	This command sets the MN-HA shared secret for the currently active profile.	<a href="#">Page 3-261</a>
<b>\$QCMIPMASS</b>	This command sets the MN-AAA shared secret for the currently active profile.	<a href="#">Page 3-262</a>
<b>\$QCMIPMHSPI</b>	This command sets the MN-HA SPIs for the currently active profile.	<a href="#">Page 3-263</a>
<b>\$QCMIPMASPI</b>	This command sets the MN-AAA SPIs for the currently active profile.	<a href="#">Page 3-264</a>
<b>\$QCMIPRT</b>	This command sets the reverse tunneling preference for the currently active profile.	<a href="#">Page 3-264</a>
<b>\$QCMIPEP</b>	This command enables/disables the currently active profile.	<a href="#">Page 3-265</a>
<b>\$QCMIPGETP</b>	This command returns the information to a specific profile.	<a href="#">Page 3-266</a>
<b>Data Capabilities</b>		
<b>\$QCQNC</b>	This command enables/disables Quick Net Connect (QNC).	<a href="#">Page 3-267</a>
<b>\$QCTRTL</b>	This command enables/disables IS2000 devices from throttling the R-SCH.	<a href="#">Page 3-268</a>
<b>\$QCSO</b>	This command sets the Data Service Option number to non-volatile memory.	<a href="#">Page 3-269</a>
<b>\$QCMIPT</b>	This command enables/disables the use of rfc2002bis authentication.	<a href="#">Page 3-270</a>
<b>\$QCMIPP</b>	This command selects MIP user profile to be active.	<a href="#">Page 3-271</a>
<b>\$QCMIP</b>	This command enables/disables Mobile IP functionality in the module.	<a href="#">Page 3-272</a>
<b>\$QCVAD</b>	This command responds to a page message that has a voice service option with a page response that has a data service option.	<a href="#">Page 3-273</a>
<b>+CTA</b>	This command is used to Set/Read/Test the Um packet data inactivity timer.	<a href="#">Page 3-274</a>
<b>+CAD</b>	This command queries the analog or digital service.	<a href="#">Page 3-275</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>+CDR</b>	This command controls whether the extended-format +CDR: intermediate result code is transmitted by the MT2.	<a href="#">Page 3-276</a>
<b>+CDS</b>	This command controls the V.42bis data compression function on the Um interface.	<a href="#">Page 3-277</a>
<b>+CRM</b>	This command enables set the protocol on the Rm interface.	<a href="#">Page 3-279</a>
<b>+CQD</b>	This command sets the timer value that specifies the period of inactivity before a Data call is released.	<a href="#">Page 3-280</a>
<b>+CMIP</b>	This command is used to display the mobile station's temporary IP address. The value displayed is in standard IP address format.	<a href="#">Page 3-280</a>
<b>+CBIP</b>	This command is used to display the base station's temporary IP address. The value displayed is in standard IP address format.	<a href="#">Page 3-281</a>
<b>+CMUX</b>	This command Used to set the maximum number of multiplex options for the forward and reverse links for MDR (HSPD) calls.	<a href="#">Page 3-282</a>
<b>+CFG</b>	This command is used to set configuration string.	<a href="#">Page 3-283</a>
<b>+CXT</b>	The command is used for cellular extension.	<a href="#">Page 3-283</a>
<b>+MV18S</b>	This command controls the manner of operation of the V.18 capabilities (if present in the IWF).	<a href="#">Page 3-284</a>
<b>+MV18R</b>	This command controls whether the extended-format +MV18R: result code is transmitted from the IWF to the mobile station.	<a href="#">Page 3-285</a>
<b>+MS</b>	This command controls the manner of operation of the modulation capabilities in the IWF.	<a href="#">Page 3-286</a>
<b>+ETBM</b>	This extended command controls the handling of data remaining in IWF buffers upon service termination.	<a href="#">Page 3-286</a>
<b>+ESR</b>	This command controls the use of the selective repeat (SREJ) option in V.42 on the PSTN link (if present in the IWF).	<a href="#">Page 3-288</a>
<b>+ES</b>	This command controls the manner of operation of the V.42 protocol on the PSTN link (if present in the IWF).	<a href="#">Page 3-289</a>
<b>+ER</b>	This command controls whether the extended-format +ER: intermediate result code is transmitted from the IWF over the Um interface.	<a href="#">Page 3-290</a>
<b>+DS</b>	This command controls the V.42 bis data compression function on the PSTN link if provided in the IWF.	<a href="#">Page 3-291</a>
<b>+DR</b>	This command controls whether the extended-format +DR: intermediate result code is transmitted from the IWF over the Um interface.	<a href="#">Page 3-292</a>
<b>+EFCS</b>	This command controls the use of the 32-bit frame check sequence option in V.42 on the PSTN link (if present in the IWF).	<a href="#">Page 3-294</a>
<b>\$QCSCRM</b>	This command enables/disables the mobile from SCRM'ing (SCRM, Supplemental Channel Request Message).	<a href="#">Page 3-294</a>
<b>\$QCMDR</b>	This command sets the Medium Data Rate (MDR) (also known as HSPD) setting.	<a href="#">Page 3-295</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>\$QCDMR</b>	This command sets the DM baud rate (for use with Diagnostic Monitor only such as QXDM).	<a href="#">Page 3-296</a>
<b>+GOI</b>	This command transmits information text, determined by the manufacturer.	<a href="#">Page 3-297</a>
<b>Audio</b>		
<b>Basic Audio Setup Commands</b>		
<b>+CRSL</b>	This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the C24.	<a href="#">Page 3-301</a>
<b>+CLVL</b>	This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the C24.	<a href="#">Page 3-302</a>
<b>+CMUT</b>	This command mutes/unmutes the currently active microphone path by overriding the current mute state.	<a href="#">Page 3-303</a>
<b>S94</b>	This S-parameter represents the Boolean status, On/Off, of the sidetone feature.	<a href="#">Page 3-304</a>
<b>S96</b>	This S-parameter represents the Boolean status, On/Off, of the echo cancelling feature in the handsfree.	<a href="#">Page 3-305</a>
<b>Advanced Audio Setup Commands</b>		
<b>+MAPATH</b>	This command sets/requests the active input accessory, and the output accessory for each feature.	<a href="#">Page 3-306</a>
<b>+MAVOL</b>	This command determines a volume setting for a particular feature in a particular accessory.	<a href="#">Page 3-308</a>
<b>+MAMUT</b>	This command controls the muting/unmuting of all input paths (MIC, HDST_MIC, DIGITAL_RX).	<a href="#">Page 3-311</a>
<b>+MAFEAT</b>	This command controls the various algorithm features, such as sidetone, echo cancel and noise suppress.	<a href="#">Page 3-312</a>
<b>General Audio Commands</b>		
<b>+MADIGITAL</b>	This command switches between analog and digital audio modes.	<a href="#">Page 3-313</a>
<b>+CALM</b>	This command handles the selection of the C24's alert sound mode.	<a href="#">Page 3-314</a>
<b>+MDMIC</b>	This command enables/disables the setting of microphone gain values by +MMICG in digital audio mode.	<a href="#">Page 3-315</a>
<b>+MMICG</b>	This command handles the selection of microphone gain values.	<a href="#">Page 3-315</a>
<b>+CRTT</b>	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	<a href="#">Page 3-317</a>
<b>+VTD</b>	This command handles the selection of tone duration.	<a href="#">Page 3-319</a>
<b>+VTS</b>	This command transmits a string of DTMF tones when a voice call is active.	<a href="#">Page 3-320</a>
<b>+MAMOD</b>	This command selects the audio mode for echo cancellation.	<a href="#">Page 3-321</a>



**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>FOTA Commands</b>		
<b>+MFOTACNFG</b>	This command enables setting the DM session as Automatic/Non-Automatic (i.e. Transparent/Non-Transparent).	<a href="#">Page 3-323</a>
<b>+MFOTAREQ</b>	This command sends FOTA requests toward DTE.	<a href="#">Page 3-324</a>
<b>+MFOTARSP</b>	This command is used to send response to +MFOTAREQ reports.	<a href="#">Page 3-325</a>
<b>+MFOTAINSTL</b>	Installs the updated package.	<a href="#">Page 3-327</a>
<b>+MFOTAABORT</b>	Aborts the DM session.	<a href="#">Page 3-327</a>
<b>+MFOTAIND</b>	This command sends Unsolicited FOTA indications toward DTE.	<a href="#">Page 3-328</a>
<b>+MFOTARLBCK</b>	This command causes the module to install the reverse firmware version.	<a href="#">Page 3-329</a>
<b>+MFOTASTART</b>	This command enable the DTE originates DM session and FOTA download & install.	<a href="#">Page 3-330</a>
<b>FOTA - OMA-DM</b>		
<b>+MODDC</b>	This command Enable/Disable the OMA-DM DC update.	<a href="#">Page 3-331</a>
<b>+MODPRL</b>	This command Enable/Disable the OMA-DM PRL update.	<a href="#">Page 3-331</a>
<b>+MODFUMO</b>	This command Enable/Disable the OMA-DM FUMO update.	<a href="#">Page 3-332</a>
<b>+MODCI</b>	This command supports the client initiating of OMA-DM session.	<a href="#">Page 3-334</a>
<b>+MODNI</b>	This command supports the NW initiating of OMA-DM session.	<a href="#">Page 3-335</a>
<b>+MODIND</b>	This command displays the progress of the updates.	<a href="#">Page 3-335</a>
<b>OTASP</b>		
<b>+MOTAIND</b>	This command displays the progress of updates.	<a href="#">Page 3-337</a>
<b>GPS - LBS</b>		
<b>Motorola Binary AT Commands</b>		
<b>+MGPSMODE</b>	This command supports the GPS operation mode.	<a href="#">Page 3-339</a>
<b>+MGPSLOC</b>	This command displays solicited/unsolicited location message to the terminal.	<a href="#">Page 3-340</a>
<b>+MGPSLUPD</b>	This command set the interval of almanac/ephemeris data downloads.	<a href="#">Page 3-341</a>
<b>+MGPSPPDEIP</b>	This command set the IP address and port for the primary PDE server.	<a href="#">Page 3-342</a>
<b>+MGPSSPDEIP</b>	This command set the IP address and port for the secondary PDE server.	<a href="#">Page 3-343</a>
<b>+MGPSMPCIP</b>	This command set the IP address and port for the MPC server.	<a href="#">Page 3-344</a>
<b>+MGPSPROT</b>	This command sets the GPS protocol.	<a href="#">Page 3-344</a>

**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>+MGPSRES</b>	This command resets all location related parameters.	<a href="#">Page 3-345</a>
<b>+MGPSQOS</b>	This command sets the GPS QoS parameters.	<a href="#">Page 3-345</a>
<b>+MNMEA</b>	This commands routes the NMEA reports to UART2 or USB.	<a href="#">Page 3-346</a>
<b>Motorola NMEA AT Commands</b>		
<b>GGA</b>	This command displays the Global Positioning System Fixed Data.	<a href="#">Page 3-347</a>
<b>GLL</b>	This command displays the Geographic Position - Latitude/Longitude.	<a href="#">Page 3-349</a>
<b>GSA</b>	This command displays the GNSS DOP and Active Satellites.	<a href="#">Page 3-350</a>
<b>GSV</b>	This command displays the GNSS Satellites in View.	<a href="#">Page 3-352</a>
<b>RMC</b>	This command displays the Recommended Minimum Specific GNSS Data.	<a href="#">Page 3-353</a>
<b>VTG</b>	This command displays the Course Over Ground and Ground Speed.	<a href="#">Page 3-354</a>
<b>ZDA</b>	This command displays the Time and Date.	<a href="#">Page 3-355</a>
<b>\$PMOTG</b>	This command Executes NMEA output message commands.	<a href="#">Page 3-356</a>
<b>MUX Feature</b>		
<b>+MMUX</b>	This command is used to enable/disable the MUX multiplexing protocol stack.	<a href="#">Page 3-364</a>
<b>Interface Commands</b>		
<b>\$QCCLR</b>	This command clears the mobile error log.	<a href="#">Page 3-380</a>
<b>+ILRR</b>	This extended-format numeric parameter controls whether the extended-format +ILRR:<rate> information text is transmitted from the MT2 to the TE2.	<a href="#">Page 3-380</a>
<b>+ICF</b>	This command determines the Character Framing.	<a href="#">Page 3-380</a>
<b>+IFC</b>	This command controls the operation of Local Flow Control between the terminal and the C24.	<a href="#">Page 3-381</a>
<b>+MTTY</b>	This AT command is used to enable or disable TTY (Tele Typewriter) support in C24 modules.	<a href="#">Page 3-383</a>
<b>Timers</b>		
<b>+MTIME</b>	This command returns 3 types of accumulated internal timers as reported by the module.	<a href="#">Page 3-385</a>
<b>Enhanced AT commands</b>		
<b>\$SPMDN</b>	This command reads the 10 digits phone number.	<a href="#">Page 3-386</a>
<b>\$SPMSID</b>	This command reads the 10 digits phone number.	<a href="#">Page 3-386</a>
<b>\$SPFWREV</b>	This command reads the current Firmware version.	<a href="#">Page 3-387</a>
<b>\$SPMIPERR</b>	This command retrieves the last MIP error from the device.	<a href="#">Page 3-387</a>



**Table 1-1: AT Commands (Cont.)**

AT Command	Description	Page
<b>\$SPSPC</b>	This command unlocks the SPC code, to enable access to protected areas of the device.	<a href="#">Page 3-387</a>
<b>\$SPPRL</b>	This command reads the current PRL number from the device.	<a href="#">Page 3-388</a>
<b>\$SPSERVICE</b>	This command reads the service to which the modem will attempt to connect.	<a href="#">Page 3-388</a>
<b>\$SPSIGDBM</b>	This command reads the current Receive Signal Strength Indicator.	<a href="#">Page 3-389</a>
<b>\$SPCURRENTLOCK</b>	This command reads the current device lock code.	<a href="#">Page 3-389</a>
<b>\$SPROAM</b>	This command selects the Roaming Preferences.	<a href="#">Page 3-389</a>
<b>\$SPERI</b>	This command reports the current enhanced roaming indicator.	<a href="#">Page 3-390</a>
<b>\$SPRMGUARD</b>	This command enables/disables the roam guard unsolicited report.	<a href="#">Page 3-391</a>
<b>\$SPLOCATION</b>	This command enables/disables the GPS service.	<a href="#">Page 3-393</a>
<b>\$SPGETLOCATION</b>	This command returns the device current location.	<a href="#">Page 3-393</a>
<b>\$SPNMEA</b>	This command enables or disables the NMEA stream.	<a href="#">Page 3-394</a>
<b>\$SPRESET</b>	This command reset the module (power off than power on).	<a href="#">Page 3-395</a>



## Chapter 2: Introduction to AT Commands

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### AT Commands Overview

AT commands are sets of commands used for communication with the C24 cellular modem.

AT commands are comprised of assemblies of ASCII characters which start with the "AT" prefix (except the commands A/ and +++). The AT prefix is derived from the word Attention, which asks the modem to pay attention to the current request (command).

AT commands are used to request services from the C24 cellular modem, such as:

- Call services: dial, answer and hang up
- Cellular utilities: send/receive SMS
- Modem profiles: Auto Answer
- Cellular Network queries: CDMA signal quality

### General Symbols Used in AT Commands Description

The following syntax definitions apply in this chapter:

Syntax	Definition
<CR>	Carriage return character, specified by the value of the S3-register.
<LF>	Line-feed character, specified by the value of the S4-register.
<...>	Name enclosed in angle brackets is a syntax element. The brackets themselves do not appear in the command line.
[...]	Optional sub-parameter of a command or an optional part of terminal information response, enclosed in square brackets. The brackets themselves do not appear in the command line. When the sub-parameter is not provided in the parameter type commands, the new value equals its previous value. In action type commands, the action should be performed on the basis of the recommended default setting of the sub-parameter.
//	Denotes a comment, and should not be included in the command.

## General System Abbreviations

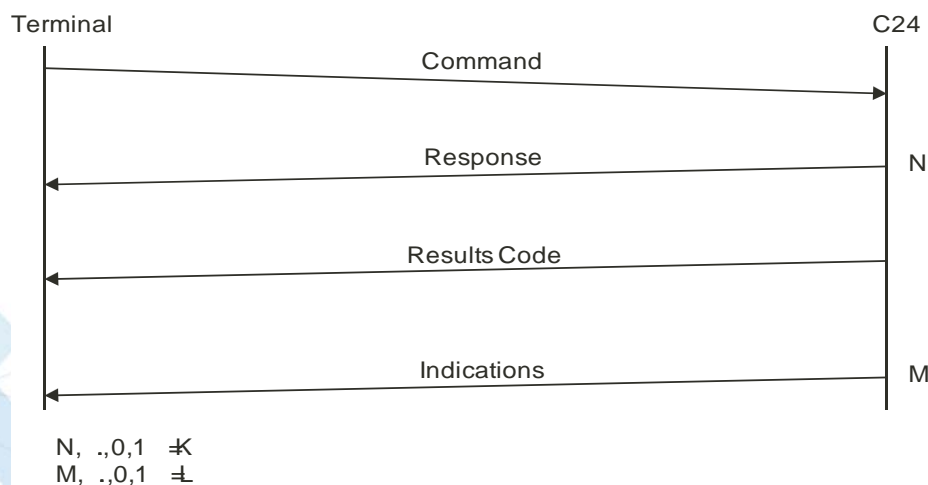
The basic system configuration contains a modem and a terminal.

The C24 is the modem and may be referred to as the DCE, the phone, the mobile or the radio.

The terminal may be referred to as the DTE or the TE.

## AT Commands Protocol

The figure below shows a general messaging sequence of AT commands protocol between the terminal and the C24.



**Figure 2-1: AT Commands Protocol**

The AT commands interface is basically a Modem Services Upon Request.

Communication (almost) always begins from the terminal side. This means that any service should be requested from the terminal. Thus a request is called a "command".

Each command must be answered by a "results code" from the C24. The results code reports the command status to the terminal.

Some commands may include several "Response" requests (between 0 to K) to send data back to the terminal.

Some commands may initiate a mode in which, when specified events are generated in the C24, "Indicator" messages are sent asynchronously. Indicators can be between 0 to L.

The C24 can echo characters received from the terminal (commands) back to the terminal.

## AT Commands Structure

### Command Structure

An AT command line may contain one or more commands. Delimiters are used to separate the commands from each other, according to the following structure:

Prefix	Command1	Delimiter	Command2	Delimiter	...	CommandN	Suffix
--------	----------	-----------	----------	-----------	-----	----------	--------

Each AT command has the "AT" prefix string.

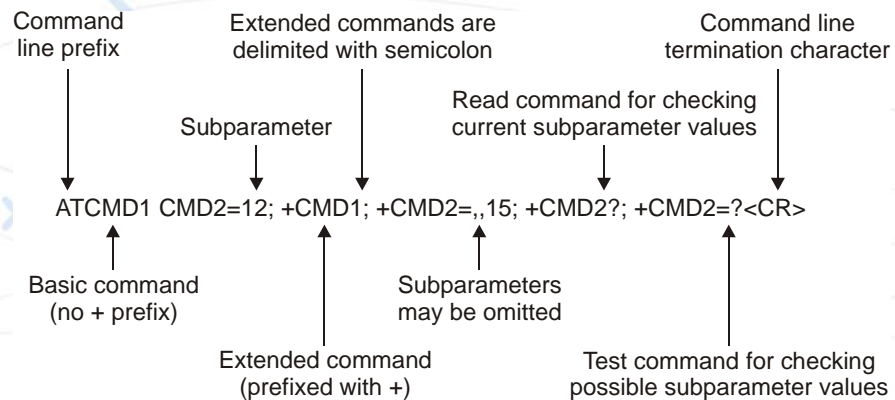
Each AT command has the suffix <CR>.

The delimiter is either a semicolon ";" or none, meaning space (basic commands).

Each AT command has the following structure:

Token	Mode	Arguments
-------	------	-----------

The following figure outlines the basic structure of an AT command line:



**Figure 2-2: Basic Structure of a Command Line**

The following rules must be observed when issuing a command line to the modem:

- Every command line must begin with the letters AT.
- Several commands can be concatenated as one line, as long as the total line does not exceed 140 characters with semicolon characters.
- Characters:

Spaces are ignored. You can leave spaces between each command and between characters of a command. You can also include punctuation in telephone numbers, and type commands in either UPPERCASE or lowercase. For example, the following commands are identical:

ATDT8005551234 <Enter> or

atdt (800) 555-1234 <Enter>

Backspace <S5> character is allowed.

- To cancel a dialing command in progress, send any ASCII character to the modem.
- To execute the command line, send the <CR> ASCII character.

## Results Code Structure

When a command is issued, the C24 responds with a message, called a "Result Code", which tells the terminal the result of the command that was requested. Result codes can indicate, for example, the execution status of the command or the remote modem connection status.

Result codes can be represented either as numerical codes or as verbose responses. By default, the C24 responds with verbose response codes.

The result code has the following structure:

Prefix	Code	Suffix
--------	------	--------

where:

The results code prefix is `<CR><LF>`.

The results code suffix is `<CR><LF>`.

## Response and Indications Structure

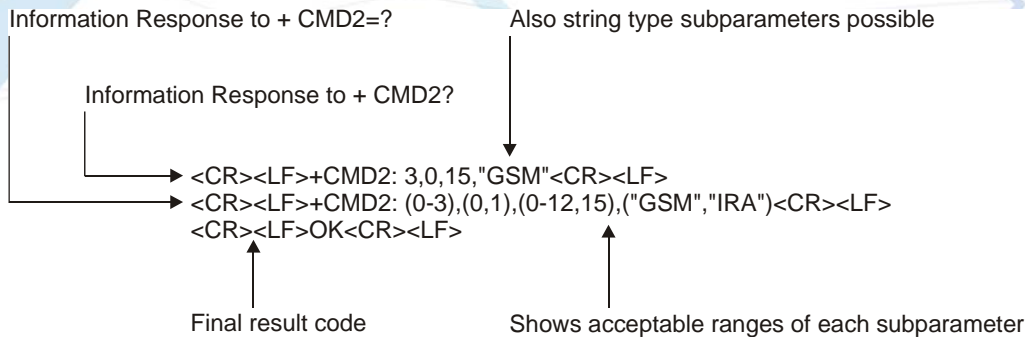
The following is the information response and indications structure:

Token	Separator	Arguments
-------	-----------	-----------

where:

The separator is ":".

The following is an example of Response and Results code:



**Figure 2-3: Response to a Command Line**

If verbose responses are enabled (using the command V1) and all the commands in a command line have been performed successfully, the result code `<CR><LF>OK<CR><LF>` is sent from the C24 to the terminal. If numeric responses are enabled (using the command V0), the result code `0<CR>` is sent instead.

If verbose responses are enabled (using the command V1) and sub-parameter values of a command are not accepted by the C24 (or if the command itself is invalid or cannot be performed for any reason), the result code `<CR><LF>ERROR<CR><LF>` is sent to the terminal and no subsequent commands in the command line are processed. If the numeric responses are enabled (using the command V0), the result code `4<CR>` is sent instead. The ERROR (or 4) response may be replaced by `+CME ERROR: <err>` when the command was not processed due to an error related to C24 operation.

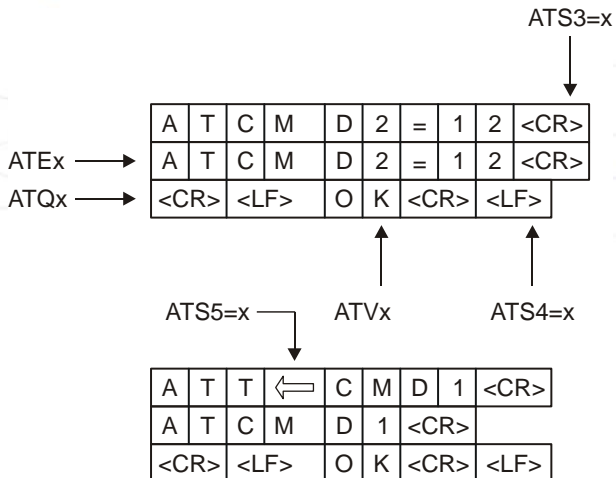
## AT Commands Protocol & Structure Configuration

The AT commands message flow and structure may be configured by the terminal.

The C24 can be configured not to follow a command with an echo and/or results code. It can be configured to transmit the results code in either of two ways: Verbose or Numeric. This (and other) configurations can be set using the following commands:

Command	Description
<b>S3=[&lt;value&gt;]</b>	Command line termination character (default setting 0x13).
<b>S4=[&lt;value&gt;]</b>	Response formatting character (default 0x10).
<b>S5=[&lt;value&gt;]</b>	Command line editing character (default 0x 8).
<b>E[&lt;value&gt;]</b>	Command echo (default 0, meaning the C24 does not echo commands).
<b>Q[&lt;value&gt;]</b>	Result code suppression (default 0, meaning the C24 transmits result codes).
<b>V[&lt;value&gt;]</b>	C24 response format (default 1, meaning verbose format).
<b>X[&lt;value&gt;]</b>	Defines CONNECT result code format.

The figure below shows the flow and structure configuration commands:



**Figure 2-4: Flow and Structure Configuration Commands**

## Command Token Types

### Basic Syntax Command Format

The format of Basic Syntax commands (except for the D and S commands) is:

**<command>[<number>]**

where:

**<command>** is either a single character, or the "&" character (IA5 2/6) followed by a single character.

Characters used in **<command>** are taken from the set of alphabetic characters.

**<number>** may be a string of one or more characters from "0" through "9" representing a decimal integer value.

### S-parameters

Commands that begin with the letter S constitute a special group of parameters known as "S-parameters". These differ from other commands in important respects:

- The number following the S indicates the "parameter number" being referenced. If the number is not recognized as a valid parameter number, an ERROR result code is issued.
- Immediately following this number, either a "?" or "=" character (IA5 3/15 or 3/13, respectively) appears:

"?" is used to read the current value of the indicated S-parameter.

"=" is used to set the S-parameter to a new value. "<parameter\_number>"

"<parameter\_number"=[<value>]

If the "=" is used, the new value to be stored in the S-parameter is specified in decimal form following the "=".

### Extended Syntax Command Format

Both actions and parameters have names, which are used in the related commands. Names always begin with the character "+" (IA5 2/11). Following the "+", from one to sixteen (16) additional characters appear in the command name.

All (CDMA) cellular commands have the prefix "+C".

All Fax commands have the prefix "+F".

All General modem commands have the prefix "+G".

Most Motorola propriety commands have the prefix "+M".



## Command Argument Types

**<value>** consists of either a numeric constant or a string constant.

**<compound\_value>** consist of several **<value>** parameters separated by commas.

Example of compound\_value: **<value1>,<value2>,...,<valueN>**

### Numeric Constants

Numeric constants are expressed in decimal, hexadecimal, or binary form. In the C24, the definition of each command specifies which form is used for values associated with that command.

### String Constants

String constants consist of a sequence of characters, bounded at the beginning and end by the double-quote character (").

## Command Mode Types

### Parameter Set Command Syntax

The terminal may store a value or values in a parameter by using the SET command.

The parameter definition indicates, for each value, whether the specification of that value is mandatory or optional. For optional values, the definition indicates the assumed (default) value if none is specified. The assumed value may be either a previous value (that is, the value of an omitted sub-parameter retains its previous value), or a fixed value (for example, the value of an omitted sub-parameter is assumed to be zero). Generally, the default value for numeric parameters is 0, and the default value for string parameters is "" (empty string).

The following syntax are used for:

- Actions that have no sub-parameters: **+<name>**
- Parameters that accept a single value: **+<name>=<value>**
- Parameters that accept more than one value: **+<name>=<compound\_value>**

### Parameter Read Command Syntax

The terminal can determine the current value or values stored in a parameter by using the following syntax: **+<name>?**

### Parameter Test Command Syntax

The terminal can test whether a parameter is implemented in the C24, and determine the supported values, by using the following syntax: **+<name>=?**

## Values

### Range of Values

When the action accepts a single numeric sub-parameter, or the parameter accepts only one numeric value, the set of supported values may be presented in the information text as an ordered list of values.

The following are some examples of value range indications:

Value Range	Description
<b>(0)</b>	Only the value 0 is supported.
<b>(1,2,3)</b>	The values 1, 2, and 3 are supported.
<b>(1-3)</b>	The values 1 through 3 are supported.
<b>(0,4,5,6,9,11,12)</b>	The several listed values are supported.
<b>(0,4-6,9,11-12)</b>	An alternative expression of the above list.

### Compound Range of Values

When the action accepts more than one sub-parameter, or the parameter accepts more than one value, the set of supported values may be presented as a list of the parenthetically enclosed value range strings (described above), separated by commas.

For example, the information text in response to testing an action that accepts three sub-parameters, and supports various ranges for each of them, could appear as follows:

**(0),(1-3),(0,4-6,9,11-12)**

## Aborting Commands

Some action commands that require time to execute may be aborted while in progress. This is explicitly noted in the description of the command. Aborting a command is accomplished by transmitting any character from the terminal to the C24. A single character is sufficient to abort the command in progress. To ensure that the aborting character is recognized by the C24, it should be sent at the same rate as the preceding command line. The C24 may ignore characters sent at other rates. When an aborting event is recognized by the C24, it terminates the command in progress and returns an appropriate result code to the terminal, as specified for the particular command.

When a command is aborted, this does not mean that its operation is reversed. In the case of some network commands, when the abort signal is detected by the C24, although the command is aborted following C24-network negotiation, the operation might be fully completed, partially completed or not executed at all.

## Core AT Commands

The C24 module responds to limited commands set when the R-UIM card is not functioning or not present or when the phone is locked. These commands are referred to as the "Core AT commands".

Generally, C24 in this state is available for the following:

**Table 2-1: Core AT Commands**

AT Command	Description	Page
\$	This command displays a list of all the AT commands supported by the C24.	<a href="#">Page 3-8</a>
?	This command displays the most recently updated value stored in an S-register.	<a href="#">Page 3-218</a>
\S	This command displays the status of selected commands and S-registers.	<a href="#">Page 3-218</a>
&C	This parameter determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	<a href="#">Page 3-132</a>
&D	This command determines how the C24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	<a href="#">Page 3-134</a>
&F	This command restores the factory default configuration profile.	<a href="#">Page 3-219</a>
&K	This command configures the flow control.	<a href="#">Page 3-139</a>
&V	This command displays the current active configuration and stored user profiles.	<a href="#">Page 3-221</a>
&W	This command stores the current active configuration to user profile 0 or 1.	<a href="#">Page 3-221</a>
&Y	This command selects power-up configuration to user's profile.	<a href="#">Page 3-223</a>
+CALM	This command handles the selection of the C24 sound mode.	<a href="#">Page 3-314</a>
+CBAUD	This command sets the baud rate.	<a href="#">Page 3-136</a>
+CBC	This command enables a user to query the battery power level.	<a href="#">Page 3-135</a>
+CDV	This command dials voice calls. <b>Note:</b> Limited to Emergency calls only.	<a href="#">Page 3-20</a>
+CEER	Extended Error Report.	<a href="#">Page 3-254</a>
+CFSN	This command displays the manufacturing serial number.	<a href="#">Page 3-7</a>
+CGMI	This command displays manufacturer identification.	<a href="#">Page 3-1</a>
+CGMM	This command requests the model identification.	<a href="#">Page 3-2</a>
+CGMR	This command displays the revision identification.	<a href="#">Page 3-3</a>
+CGSN	This command displays the product serial number identification in decimal format.	<a href="#">Page 3-3</a>
+CHV	This command hangs-up a voice call.	<a href="#">Page 3-20</a>

**Table 2-1: Core AT Commands (Cont.)**

AT Command	Description	Page
<b>+CIMI</b>	This command displays the International Mobile Subscriber Identity number.	<a href="#">Page 3-7</a>
<b>+CIND</b>	This command is used to query the status of various ME indicators.	<a href="#">Page 3-101</a>
<b>+CLAC</b>	This command displays a list of all the AT commands supported by the C24.	<a href="#">Page 3-9</a>
<b>+CLCC</b>	This command displays a list of all current C24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	<a href="#">Page 3-39</a>
<b>+CLVL</b>	This command sets the volume of the internal loudspeaker (which also affects the Key feedback tone) of the C24.	<a href="#">Page 3-302</a>
<b>+CMEE</b>	The Set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the C24.	<a href="#">Page 3-250</a>
<b>+CMER</b>	Mobile Equipment Event Reporting.	<a href="#">Page 3-97</a>
<b>+CMUT</b>	This command is used to mute/unmute the currently active microphone path by overriding the current mute state.	<a href="#">Page 3-303</a>
<b>+CPAS</b>	This command displays the current activity status of the C24, for example, call in progress, or ringing.	<a href="#">Page 3-38</a>
<b>+CPIN</b>	This command unlocks the R-UIM card when the proper R-UIM PIN is provided and unblocks the R-UIM card when the proper R-UIM PUK is provided.	<a href="#">Page 3-104</a>
<b>+CRSL</b>	This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the C24.	<a href="#">Page 3-301</a>
<b>+CSCS</b>	This command selects the C24 character set.	<a href="#">Page 3-5</a>
<b>+CSQ</b>	This command returns the Signal Quality Measure <SQM> and the Frame Error Rate <FER> from the C24.	<a href="#">Page 3-89</a>
<b>+FMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-1</a>
<b>+FMM</b>	This command displays the model identification.	<a href="#">Page 3-2</a>
<b>+FMR</b>	This command displays the revision identification.	<a href="#">Page 3-3</a>
<b>+GCAP</b>	This command indicates the major capability areas of the C24.	<a href="#">Page 3-132</a>
<b>+GMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-1</a>
<b>+GMM</b>	This command displays the model identification.	<a href="#">Page 3-2</a>
<b>+GMR</b>	This command displays the revision identification.	<a href="#">Page 3-3</a>
<b>+GOI</b>	Device Identification.	<a href="#">Page 3-297</a>
<b>+GSN</b>	This command requests the product serial number identification in Hex format.	<a href="#">Page 3-3</a>
<b>+ICF</b>	This command determines the Character Framing.	<a href="#">Page 3-380</a>
<b>+IFC</b>	This command controls the operation of Local Flow Control between the terminal and the C24.	<a href="#">Page 3-381</a>

**Table 2-1: Core AT Commands (Cont.)**

AT Command	Description	Page
<b>+ILRR</b>	TE2-MT2 Local Rate Reporting.	<a href="#">Page 3-380</a>
<b>+IPR</b>	This command is responsible for setting and saving the request baud rate.	<a href="#">Page 3-138</a>
<b>+MADIGITAL</b>	This command switches between analog and digital audio modes.	<a href="#">Page 3-313</a>
<b>+MAFEAT</b>	This command controls the algorithm features: sidetone, echo cancel and noise suppression.	<a href="#">Page 3-312</a>
<b>+MAMOD</b>	This command selects the audio mode for echo cancellation.	<a href="#">Page 3-321</a>
<b>+MAMUT</b>	This command controls the muting/unmuting of all input paths (mic, headset mic or digital RX).	<a href="#">Page 3-311</a>
<b>+MAPATH</b>	This command sets/requests the active input accessory, and the output accessory for each feature.	<a href="#">Page 3-306</a>
<b>+MAVOL</b>	This command enables you to determine a volume level for a particular feature via a particular accessory.	<a href="#">Page 3-308</a>
<b>+MCST</b>	This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.	<a href="#">Page 3-42</a>
<b>+MDMIC</b>	This command Enables/Disables the setting of the microphone level in digital audio mode.	<a href="#">Page 3-315</a>
<b>+MECALL</b>	This unsolicited report sends indication of an emergency call to the terminal.	<a href="#">Page 3-44</a>
<b>+MMICG</b>	This command handles the selection of microphone gain values of MIC-handsets (not MIC-headsets).	<a href="#">Page 3-315</a>
<b>+MMUX</b>	Enable MUX mode.	<a href="#">Page 3-364</a>
<b>+MPESND</b>	Requests Pseudo Electronic Serial Number Identification in Decimal.	<a href="#">Page 3-4</a>
<b>+MPESNH</b>	Requests Pseudo Electronic Serial Number Identification in Hex.	<a href="#">Page 3-5</a>
<b>+MPIN</b>	This command enables the accessory application to unlock the phone when the appropriate unlock code has been provided.	<a href="#">Page 3-103</a>
<b>+MREFLASH</b>	Enter to Re-Flash Mode.	<a href="#">Page 3-257</a>
<b>+MRST</b>	The +MRST command enables customer software to perform a hard reset to the C24 unit.	<a href="#">Page 3-143</a>
<b>+MSCTS</b>	This command defines the behavior of the CTS line when the C24 is in normal mode (not Sleep mode).	<a href="#">Page 3-229</a>
<b>+MSSI</b>	This command enables/disables the unsolicited report for signal strength value.	<a href="#">Page 3-90</a>
<b>+MTTY</b>	This command is used to enable/disable the TTY (Tele Typewriter) support in the C24.	<a href="#">Page 3-383</a>
<b>+TPIN</b>	This command returns the number of remaining attempts of entering the PIN and PUK for the R-UIM card in use.	<a href="#">Page 3-108</a>
<b>+VTD</b>	This command handles the selection of tone duration.	<a href="#">Page 3-319</a>

**Table 2-1: Core AT Commands (Cont.)**

AT Command	Description	Page
<b>+VTS</b>	This command transmits a string of DTMF tones when a voice call is active.	<a href="#">Page 3-320</a>
<b>\$QCCLR</b>	This command clears the mobile error log.	<a href="#">Page 3-380</a>
<b>A/</b>	This command repeats the last command entered on the terminal.	<a href="#">Page 3-104</a>
<b>AT</b>	This command checks the AT communication and only returns OK.	<a href="#">Page 3-104</a>
<b>D</b>	This command places a voice call on the current network, when issued from an accessory device. <b>Note:</b> Limited to Emergency call only.	<a href="#">Page 3-12</a>
<b>E</b>	This command defines whether input characters are echoed to output.	<a href="#">Page 3-214</a>
<b>H</b>	This command hangs up, or terminates a particular call.	<a href="#">Page 3-16</a>
<b>I</b>	This command displays various C24 information items.	<a href="#">Page 3-7</a>
<b>Q</b>	This command determines whether to output the result codes.	<a href="#">Page 3-213</a>
<b>S[n]</b>	These commands set/get/read the values of S-register parameters.	<a href="#">Page 3-216</a>
<b>V</b>	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	<a href="#">Page 3-212</a>
<b>X</b>	This command defines the CONNECT result code format.	<a href="#">Page 3-215</a>
<b>Z</b>	This command drops the current call, and resets the values to default configuration.	<a href="#">Page 3-220</a>

## Chapter 3: AT Commands Reference

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### Modem ID

#### Subscriber Unit Identity

These commands allow the user to query the type of attached device, the technology used in the device, as well as basic operating information about the device.

#### +CGMI, +GMI, +FMI, Request Manufacturer ID

These commands display manufacturer identification. The C24 outputs a string containing manufacturer identification information, indicating that this is a Motorola device.

Command	Response/Action
AT+CGMI AT+CGMI?	+CGMI: "Motorola"
AT+GMI AT+GMI?	+CGMI: "Motorola"
AT+FMI AT+FMI?	+CGMI: "Motorola"

#### Example

```
AT+CGMI
+CGMI: "Motorola"
OK
AT+GMI
+CGMI: "Motorola"
OK
AT+FMI
+CGMI: "Motorola"
```

## +CGMM, +GMM, +FMM, Request Model ID

These commands request the model identification. The C24 outputs a string containing information about the specific model, including a list of the supported technology used, and the particular model number.

Command	Response/Action
AT+CGMM AT+CGMM?	+CGMM: <list of supported technologies>,<model>
AT+GMM AT+GMM?	+GMM: <list of supported technologies>,<model>
AT+FMM AT+FMM?	+FMM: <list of supported technologies>,<model>

### Example

```
AT+GMM
+GMM: "CDMA800","CDMA1900","MODEL=C24"
OK
```

```
AT+CGMM
+CGMM: "CDMA800","CDMA1900","MODEL= C24 "
OK
```

```
AT+FMM
+FMM: "CDMA800","CDMA1900","MODEL= C24"
OK
```

The following table shows the +CGMM string parameters.

String	Description
"CDMA800"	CDMA at 800 MHz
"CDMA1900"	CDMA at 1900 MHz



## +CGMR, +GMR, +FMR, Request Revision

These commands request the revision identification. The C24 outputs a string containing the revision identification information of the software version contained within the device.

Command	Response/Action
AT+CGMR AT+CGMR?	+CGMR: <revision>
AT+GMR AT+GMR?	+GMR: <revision>
AT+FMR AT+FMR?	+FMR: <revision>

### Example

```
AT+CGMR
+CGMR: "C24_G_0C.11.61R"
AT+GMR
+GMR: "C24_G_0C.11.61R"
AT+FMR
+FMR: "C24_G_0C.11.61R"
```

## +CGSN, Request Product Serial Number Identification

This command returns the Mobile Equipment Identifier (MEID) of the product in decimal format only.

**Note:** MEID number replaces the ESN (Electronic Serial number).

Command	Response/Action
AT+CGSN AT+CGSN?	+CGSN: <sn>

The following table shows the +CGSN parameters.

**Table 3-1: +CGSN Parameters**

<Parameter>	Description
<sn>	Decimal number indicating the mobile equipment identifier (MEID).

### Example

```
AT+CGSN?
+CGSN: "066 16466101"
OK
```

## +GSN, Request Product Serial Number Identification

This command returns the Mobile Equipment Identifier (MEID) of the product in Hexadecimal format only.

**Note:** MEID number replaces the ESN (Electronic Serial number).

Command	Response/Action
AT+GSN AT+GSN?	+GSN: <sn>

The following table shows the +GSN parameters.

**Table 3-2: +GSN Parameters**

<Parameter>	Description
<sn>	Hexadecimal number indicating the mobile equipment identifier (MEID).

### Example

```
AT+GSN
+GSN: "42FB40B5"
OK
```

## +MPESND, Request Pseudo Electronic Serial Number Identification in Decimal

This command returns the Pseudo Electronic Serial Number (pESN) of the product in decimal format only.

Command	Response/Action
AT+MPESND AT+MPESND?	+MPESND: <sn>

The following table shows the +MPESND parameters.

**Table 3-3: +MPESND Parameters**

<Parameter>	Description
<sn>	Decimal number indicating the Pseudo Electronic Serial Number (pESN).

### Example

```
AT+MPESND?
+MPESND: "12805134855"
OK
```

## +MPESNH, Request Pseudo Electronic Serial Number Identification in Hex

This command returns the Pseudo Electronic Serial Number (pESN) of the product in Hex format only.

Command	Response/Action
AT+MPESNH AT+MPESNH?	+MPESNH: <sn>

The following table shows the +MPESNH parameters.

**Table 3-4: +MPESNH Parameters**

<Parameter>	Description
<sn>	Hex number indicating the Pseudo Electronic Serial Number (pESN).

### Example

```
AT+MPESNH?
+MPESNH: "804E5A07"
OK
```

## +UMID, Request User Identification Module Identifier

This command returns the User Identification Module Identifier (UIMID) of the R-UIM.

**Note:** In case of non R-UIM Module this command will return CME Error : "operation not supported".

Command	Response/Action
AT+UMID AT+UMID?	+UMID: <un>

The following table shows the +UMID parameters.

**Table 3-5: +UMID Parameters**

<Parameter>	Description
<un>	User id module identifier (UIMID) number.

## +CSCS, Select Terminal Character Set

This command selects the C24 character set. The C24 supports the following character sets: GSM, UCS2, UTF8, 8859-1 and ASCII.

The default value, set upon system initialization or when omitting <chset> in set command, is ASCII.

Command Type	Syntax	Response/Action
<b>Set</b>	+CSCS=[<chset>]	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>
<b>Read</b>	AT+CSCS?	<b>+CSCS: &lt;selected character set&gt;</b>
<b>Test</b>	AT+CSCS=?	<b>+CSCS: (&lt;supported character sets&gt;)</b>

The following table shows the +CSCS parameter optional values.

**Table 3-6: +CSCS Parameters**

<chset>	Character Set	Input/Output Format
<b>"ASCII"</b>	ASCII (0x00 - 0x7F)	Quoted string. (For example, "AB" equals two 8-bit characters with decimal values 65, 66.)
<b>"GSM"</b>	GSM default alphabet (GSM 03.38 subclause 6.2.1)	HEX representation.
<b>"UCS2"</b>	Unicode (ISO/IEC 10646 [32])	HEX representation. (For example, 00410042 equals two 16-bit characters with decimal values 65, 66.)
<b>"UTF8"</b>	8-bit Unicode (ISO 10646 transformation format)	HEX representation.
<b>"8859-1"</b>	LATIN (ISO 8859-1)	Quoted string.

### Example

```

AT+CSCS=?
+CSCS: ("8859-1","ASCII","GSM","UCS2","UTF8")
OK
AT+CSCS?
+CSCS: "ASCII"
OK
AT+CPBS = "ME"
AT+CPBW=1,"8475763000",129,"Lin Zhao"
OK
AT+CSCS="UCS2"
OK
AT+CPBR=1
+CPBR: 1,"8475763000",129,"004C006E006E0020005A00680061006F"
OK
AT+CSCS="ASCII"

```

```

OK
AT+CPBR=1
+CPBR: 1,"8475763000",129,"Lin Zhao"
OK

```

### +CIMI, Request IMSI

This command displays the International Mobile Subscriber Identity number.

Command	Response/Action
AT+CIMI AT+CIMI?	+CIMI: <imsi> or: +CME ERROR: <err>

#### Example

```

AT+CIMI
+CIMI: 314566320021400

```

### +CFSN, Read Factory Serial Number

This command is used to query the Motorola Manufacturing Serial Number (MSN), as specified in SOP-29.

Command	Response/Action
AT+CFSN?	+CFSN: <Motorola Serial Number>

#### Example

```

AT+CFSN?
+CFSN: "408HHL0A01"
OK

```

### I, Request Identification Information

This command displays various C24 information items.

In case ATI is sent without parameter it should response as ATI3.

Command	Response/Action
ATI <i>n</i>	<information item <i>n</i> > or: +CMS ERROR: <err>

The following table shows the information items that are supported by the C24.

ATIn	Description	Output
1	Reports Product Model	C24.
2	Reports Model Number	F80ABXYZ  F80 - C24 designator AB - Operator designator X - Flex revision Y - HW revision Z - SW version
3	Reports Product Title	Motorola CDMA Module
4	Reports PRL Version	<current PRL revision>
5	Reports Software Architecture	3350
6	Reports PRI Version	<current PRI revision>
7	Reports Product Description	<current module type>
8	Reports Software Version	<current software revision>
9	Reports Flex Version	<current flex version>

#### Example

```
ATI7
C24 OEM Module
OK
ATI8
C243D18.04
OK
ATI9
C24USPT002
OK
ATI6
C24PSPT002
OK
```

#### \$, List of All Available AT Commands

This command displays a list of all the AT commands supported by the C24.

Command	Response/Action
AT\$	List of available AT commands

## +CLAC, List of All Available AT Commands

Command	Syntax	Response/Action	Remarks
<b>Execute</b>	<b>+CLAC</b>	List of available AT commands	The Execute command displays a list of all the AT commands supported by the C24.

### Example

```
AT+CLAC
$
%C
&C
&D
:
:
:
:
\A
\S
OK
```

### Capability Reporting

This set of commands enables a user to determine C24's protocol level. It also enables other support provided by the C24, such as information about the currently implemented protocol version (used to detect older C24s that may not support all commands), as well as determining which optional commands are implemented in a particular C24 software load.

## Call Control

### Common Operation

#### Managing a CSD (Data) Call

The C24 working modes can be divided into two modes of operation.

- **Data Mode:** In this mode, once the C24 has established a link with the remote modem, it does not respond to any data passing through it (except for the Escape Sequence search). The C24 becomes a transparent link, connecting the terminal with the remote side.
- **Command Mode:** In this mode, the C24 responds to the AT commands issued by the terminal. This is the default working mode.

**Note:** It is possible to switch between the operating modes.

The Terminal mode allows you to instruct the modem to dial a remote modem by issuing the Dial command followed by the phone number. You can also include dial string modifiers in your command line to give the modem additional instructions. The following dial modifiers are available on most modems:

- `,"` - Pause

#### Simple Dialing

In order to instruct the modem to dial a remote modem from an ordinary tone-dialing telephone line, enter the Dial command followed by the phone number. For example, type the following command:

**ATD 876-5555 <Enter>**

**Note:** If you receive characters which were sent, you can disable this with using the Echo command (ATE0 <Enter>).

After issuing the Dial command, and if the remote modem answers the call, the two modems send high-pitched carrier tones to one another which establish the transmission speed and other parameters for the data connection. This process is called negotiation.

After the negotiation process, the message, "OK" followed by the connection speed, is received.

If the other phone line is busy, the message "NO CARRIER" is received.

If the other modem does not answer, the message "NO CARRIER" is received.

Once a connection has been established, the modem is ready to immediately begin transmitting and receiving data. This may vary from sending messages to each other, sending or receiving files, logging on to an information service, or any other data communication task you wish to perform.



## Switching From Data Mode to Command Mode

To switch the connection from Data mode to Command mode, send the Escape Sequence command (+++).

If the modem responds with "OK" to the Escape command, the modem is in Command mode and the dial connection is still active, and you can use the AT command set.

## The character '+'

Escape is detected only by the C24 and not by the remote side. The remote side stays in the Data mode.

## Hanging Up

If you are using a communications program, use the "Hang up" or "Disconnect" AT command in the program to disconnect the call.

When using computers in the "Dumb Terminal mode", return to the Command mode by typing the Escape Sequence, +++, and then hang up by typing the Hang up command as follows:

**ATH <Enter>**

If the C24 responds with "OK", the dial connection is closed.

## Dialing to an Electronic Telephone Service

When you dial to an electronic telephone service such as telephone banking, you must typically instruct the modem to dial a number, then to wait for call establishment, and then send the password for entering the banking account. A typical command line might look like this:

**ATD876-5555,123456; <Enter>**

The modem dials the number, then pauses to wait for the call connection (the comma in the command line causes the pause).

You can also create a longer pause by including several commas in a row in the command line, and then send the password to the service.

## Receiving a Data Call

**ATA <Enter>**

This command instructs the modem to be the "answering modem". Either party may be the answering or the originating modem, but both parties cannot be the same modem at the same time.

You hear the modem handshake and see the result code "CONNECT".

**Note:** Outgoing Voice Call during CSD Call, when switching to Command mode.

If using Dial Command to make Outgoing Voice Call, currently active CSD Call is dropped and the new Voice Call is generated.

## Call Control AT Commands

### D, Dial Command

This command places a FAX/DATA/VOICE call on the current network.

The default call type is a data call (CSD). If the +FCLASS command was used to set the call type to be FAX, then the outgoing call is a fax call.

There must be an explicit request in order to make a VOICE call. This request bypasses the +FCLASS setting.

If a DATA/FAX call was originated and answered by the remote side, a "OK" notification is sent to the terminal from the C24, and it moves to the online Data/Fax state (respectively).

For more information about call failure, use the AT+CEER command, described in [“+CEER, Extended Error Report”](#) on page 3-254.

**Note:** If there is an active voice call and the terminal sends another AT+MAIF=<number> voice call command to the C24, the active call is put on hold and the new number is called.

Command	Response/Action
ATD<number>[;]	VOICE CALL: 1st response - Voice call place begins <b>OK</b> 2nd response - Voice call connected: <b>OK</b> DATA/FAX: 2nd response only - Data/Fax call connected <b>CONNECT</b> When MO call fails: 1. Connection Failure - NO CARRIER or BUSY or NO ANSWER 2. General Failure - ERROR 3. Security reason (such as phone is locked) - OPERATION NOT ALLOWED 4. Unknown reason - UNKNOWN CALLING ERROR

The following table shows the D parameters.

**Table 3-7: D Parameters**

<Parameter>	Description
<number>	Valid phone digits are: 0 1 2 3 4 5 6 7 8 9 * # + and, The following characters are ignored: A B C D - ( ) / and <space>. The comma <,> digit: When dialing a voice call, digits until the comma are considered addressing information (phone number). Any digits after the comma are sent as DTMF tones after the voice call is connected. More than one comma causes a pause in sending the tones. When dialing a data/fax call, the comma digit is ignored, and all other digits before and after the comma are considered addressing information (phone number). The plus <+> digit: Indicates that the international access code exists in the number.
semicolon (;)	When given after <number string>, a voice call is originated to the given address, otherwise a data call is originated.

**Note:** ATDP, ATDT, AT\*D, <T>, <P> and <\*> are ignored. The command is handled as ATD.  
The control of supplementary services through the Dial command is not supported as these are controlled through the specific supplementary service commands (CLCK, and so on.)

ATD#777 command is used to originate a CDMA-1X packet session.

#### Example

```

atd44345678;           //VOICE call (with semicolon)
OK
OK
atd44345678           //DATA/ FAX call (without semicolon)
...
CONNECT               //Move to online Data state

```

### D>, Direct Dialing from Phone Books

This command places a FAX/DATA/VOICE call on the current network by dialing directly from the C24 phone book.

- Notes:**
- "+CME ERROR: not found" is returned when no match is found in an existing phone book.
  - "+CME ERROR: Invalid index" is returned when entry <n> is out of the requested Phonebook range.

The following table shows a detailed description for the D> commands.

Command	Detailed Description
<b>D&gt;&lt;alpha&gt;[:]</b>	Originates a call to a phone number with the corresponding alphanumeric field <alpha>. The Current Phone Book (Set by +CPBS) is searched for the entry that begins with the alphanumeric pattern <alpha>.
<b>D&gt;mem&lt;n&gt;[:]</b>	Originates a call to a phone number in memory (phone book) mem and stored in entry location <n>. Available memories may be queried with Select Phone Book Storage Test command +CPBS. <b>Note:</b> This command does not change the used memory set.
<b>D&gt;&lt;n&gt;[:]</b>	Originates a call to a phone number from entry location <n> in the Current Phone Book (Set by +CPBS).

**Note:** Current used memory (phone book) set/read is done through the memory command +CPBS=/+CPBS? respectively.  
In case of the same "Alpha" for the different Telephone numbers, the first found number will be dialed.

The following table shows the D> parameters.

**Table 3-8: D> Parameters**

<Parameter>	Description
<b>&lt;"alpha"&gt;</b>	String type value, which should be equal to an alphanumeric field in a phone book entry. The used character set should be the one selected with Select Terminal Character Set +CSCS. <alpha> is case-sensitive, and should be placed in quotes ("alpha").
<b>&lt;n&gt;</b>	This parameter is also called "speed dial location". It is an integer type memory location. <n> should be in the range of locations available in the memory used.
<b>&lt;"mem"&gt;</b>	This parameter is not case-sensitive, and should be placed in quotes ("mem").

### Example

```
AT+CPBS="me"           //Phone flash memory
OK
AT+CSCS="ASCII"        //ASCII characters
OK
AT+CPBW=1,"035659090",129,"VoiceMail"
OK
AT+CPBR=1
+CPBR: 001,"035659090",129,"VoiceMail"
OK
atd>"VoiceMail";      //Phonebook by name
OK
OK
at+chv
NO CARRIER
```

```

OK
atd>1;                                //Speed dial from phonebook
OK
OK
at+chv
NO CARRIER
OK
atd>1                                //Speed dial from phonebook
+CME ERROR:                          //Invalid characters in dial string
atd>"Motorola Internal"
+CME ERROR:                          //Invalid characters in dial string

```

For more examples, refer to [“Call Control” on page 4-15](#) and [“Data Call” on page 4-19](#).

## DL, Dial Last Number

The DL command places a data/voice call to the last number dialed. The call progress information (success/failure) is reported in the same way as for the Dial command. (Refer to [“D, Dial Command”, page 3-12](#)).

Command	Detailed Description
<b>ATDL[;]</b>	Initial Response - Last Number retrieved: ATDL: "DIAL DIGITS" 2nd response - Data/Fax call connected CONNECT 1st response - Voice call placement begins OK 2nd response - Voice call connected OK

The following table shows the DL parameters.

**Table 3-9: DL Parameters**

<Parameter>	Description
<b>semicolon (;)</b>	If the semicolon (;) is given, a voice call is originated to the last dialed number. If the semicolon (;) is not given, a Fax/Data call is originated. <b>Note:</b> The last dialed call type is irrelevant to the DL command.

**Note:** When ATDL is issued after a dialed number with comma digit:

- ATDL; (Voice) dials the exact number that was last dialed, including the DTMF tones sent.
- ATDL (Data/Fax) dials the addressing information only (comma and tones are discarded).
- If ATDL is sent before any Dial command was issued (mainly after Power On, when the last number is an empty field), the C24 will return NO CARRIER, as mentioned in the ITU V.25-ter standard.

### Example

```

atdl                               //Last called number is "035658278"
ATDL: "035658278"
OK                                 //DATA call
atdl;
ATDL: "035658278"
OK
OK                                 //VOICE call
atdl                               //Last called number is "035658278,123,78;"
ATDL: "035658278"
CONNECT                           //DATA call
atdl;                             //Last called number is "035658278,123,78"
ATDL: "035658278,123,78"
OK
OK                                 //VOICE call
1 2 3                             //Sent as DTMF tones
...                               //Pause
7 8                               //Sent as DTMF tones

```

### H, Hang-up Call

This command hangs up only data call. The C24 terminates the call whether it is an incoming, originating or connected call.

A NO CARRIER message is returned to the terminal before the regular OK approval.

**Note:** To hung up voice call, +CHV command should be used.

To terminate (hang-up) a MO data/fax call while call is placed (before CONNECT message): Any character sent from the terminal to the C24 causes the Data/Fax call termination, and NO CARRIER is sent from the C24 to the terminal.

The following table shows the call states of the H command.

Call State	Response/Action
IDLE	Error 3 ("operation not allowed")
Single Party	Call released
Incoming Call (RING)	Call released

**Example**

```

RING                                //Incoming call
RING                                //Incoming call
ath                                  //Hang-up incoming call
NO CARRIER
OK                                  //Incoming call has been terminated - user determined user busy
atd035659260
CONNECT//Data call connected - Online Data mode
...
+++                                //ESC Sequence is sent from the terminal to the C24
OK                                  //The C24 is in Command mode
ath                                  //Terminate Data call
NO CARRIER
OK

```

**A, Answer Incoming Call**

This command answers an incoming VOICE/DATA/FAX call after a RING/+CRING indication is sent to the terminal.

If the incoming call is answered (connected), the C24 sends a CONNECT notification to the terminal.

If the MT call fails, the possible notifications are:

- NO CARRIER - Connection Failure
- ERROR - General Failure

**Note:** A waiting call (an incoming call while a call is in progress) is announced by +CCWA rather than RING. A waiting call can be answered only if it is a voice call. The waiting voice call should be answered using the ATA command, which will put the active call on hold and will connect the waiting call, making it the active call.

**Example**

**Example - Answering a voice call:**

```

AT+CRIC=1
+CRING: VOICE
+CRING: VOICE
ata
OK                                  //VOICE call connected - C24 is in Command mode
at+chv
NO CARRIER
OK

```

**Example - Answering a data call:**

```

+CRING: DATA
+CRING: DATA
ata
...                                //Connecting (dots are not displayed)
OK                                  //DATA call connected - C24 is in Online Data mode

```

**Note:** In a CSD call, call release is not valid during the phase of call negotiation (from OK until connect call).

## +MARS, Motorola Auto Redial Status Reporting

This command enables the C24 to report when auto redial starts or ends, when enabled. An accessory can enable this reporting using the +MARS set command. The unsolicited message "+MARS:<status>" is sent from the C24 to the terminal when the auto redial starts or ends. This command is applicable for voice calls only.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MARS=<mode>	+MARS:<status> or: +CME ERROR: <err>	Reports the auto-redial status.
<b>Read</b>	+MARS?	+MARS: <mode> OK	
<b>Test</b>	+MARS=?	+MARS: (<list of supported modes>) OK	

The following table shows the +MARS parameters.

**Table 3-10: +MARS Parameters**

<Parameter>	Description
<mode>	0 Disables auto-redial reporting. 1 Enables auto-redial reporting.
<status>	0 Auto-redial ends. 1 Auto-redial starts.

### Example

```
+MARS:1                //Auto-redial mode starts

AT+MARS=0              //Disable auto-redial reporting
OK
```

## +MARD, Enable/Disable Auto-Redial

This command enables and disables the auto-redial capability of the C24.

The auto-redial feature is related to voice services only, and initiates only when call failed because of network reason.



The number of redials is not saved after power up, its default is 1 redial, after <number of retries> redials, call will be canceled.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+MARD=&lt;state&gt;,&lt;number of retries&gt;</b>	<b>OK</b>	The Set command Sets/clears auto-redial state and number of retries.
<b>Read</b>	<b>+MARD?</b>	<b>+MARD: &lt;state&gt;,&lt;number of retries&gt;</b> <b>OK</b>	The Read command displays the current auto-redial state and number of retries.
<b>Test</b>	<b>+MARD=?</b>	<b>+MARD: (&lt;list of supported states&gt;), (&lt;list of supported number of retries&gt;)</b> <b>OK</b>	

The following table shows the +MARD parameters.

**Table 3-11: +MARD Parameters**

<Parameter>	Description
<b>&lt;state&gt;</b>	0 Auto-redial disabled (default). 1 Auto-redial enabled.
<b>&lt;number of retries&gt;</b>	1-255 (1 - default).

### Example

```
AT+MARD?
+MARD: 0
OK
AT+MARD=1,10
OK
```

### \$QCCAV, Answer Incoming Voice Call

This command answers an incoming voice call.

Command	Response/Action
<b>\$QCCAV</b>	<b>OK</b>

## +CHV, Hang-up Voice Call

This command hangs-up a voice call.

Command	Response/Action
<b>+CHV</b>	<b>NO CARRIER</b>

## +CDV, Dial Voice Call

This command dials voice calls.

Command	Response/Action
<b>+CDV&lt;number&gt;</b>	<b>OK</b> <b>or:</b> <b>NO CARRIER</b>

### Example

```
AT+CDV057729619
OK
```

## +CRC, Cellular Result Codes and RING, +CRING - Incoming Call Indication

This command controls whether or not to present the extended format of an incoming call indication. The RING/+CRING indication is sent from the C24 to the terminal when the C24 is alerted by an incoming call from the network. Once this indication is sent, information is available on the calling line via +CLIP. When +CRC is disabled, the indication is RING, and when +CRC is enabled, the indication is +CRING.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+CRC=[&lt;n&gt;]</b>	<b>OK</b>	The Set command enables/disables the extended format of an incoming call indication. When enabled, an incoming call is indicated to the terminal with an unsolicited result code +CRING:<type> instead of the normal RING.
<b>Read</b>	<b>+CRC?</b>	<b>+CRC: &lt;n&gt;</b> <b>OK</b>	The Read command queries the current settings for the cellular result code.
<b>Test</b>	<b>+CRC=?</b>	<b>+CRC: (list of supported &lt;n&gt;s)</b>	The Test command returns the possible <n> values.

**RING/+CRING Indication****+CRING: <type>****or:****RING**

The following table shows the +CRC parameters.

**Table 3-12: +CRC Parameters**

<Parameter>	Description								
<n>	0      Extended format disabled 1      Extended format enabled The default value is 0.								
<type>	<table border="1"> <tr> <td>+CRING:VOICE</td><td>For normal voice calls.</td></tr> <tr> <td>+CRING:DATA</td><td>For all types of data calls.</td></tr> <tr> <td>+CRING:FAX</td><td>For all types of fax calls.</td></tr> <tr> <td>+CRING:UNKNOWN</td><td>for unknown/undefined calls types</td></tr> </table>	+CRING:VOICE	For normal voice calls.	+CRING:DATA	For all types of data calls.	+CRING:FAX	For all types of fax calls.	+CRING:UNKNOWN	for unknown/undefined calls types
+CRING:VOICE	For normal voice calls.								
+CRING:DATA	For all types of data calls.								
+CRING:FAX	For all types of fax calls.								
+CRING:UNKNOWN	for unknown/undefined calls types								

**Example****AT+CRC?****+CRC: 0****OK****AT+CRC=?****+CRC: (0-1)****OK****Example - RING/+CRING indication****(..Incoming Data Call..)****RING****RING****RING****AT+CRC=1****//Enable extended ring format****OK****+CRING: DATA****+CRING: DATA****ath****AT+CRC=1****OK****//Mobile fax call terminated (multi-numbered scheme) from PSTN fax machine****+CRING: FAX**

## O, Return to Online Data State

This command returns the C24 from the Command mode to the Online Data mode and issues a CONNECT or CONNECT <text> result code.

After dialing or answering (atd/ata commands and connect), the phone enters the Online Data mode where it is able to transfer data, but not to enter AT commands.

The ESC command +++, transfers the phone to the Command mode (able to input AT commands, while preserving the Data call). The O command returns the phone to the fully Online Data mode (as it was before using the ESC command).

**Note:** The escape character '+' can be changed using the S2-register.

The time delay between consecutive escape characters is configured using the S12-register.

Command Type	Syntax	Response/Action
Execute	ATO	<b>CONNECT</b> <b>+CME ERROR: &lt;err&gt;</b> If phone is not in Data Call <b>NO CARRIER:</b> If connection is not successfully resumed.

### Example

```
ATD035684072 //Calling a remote modem - data call
CONNECT      //C24 is in Data mode
             //Escaping back to Command mode using the +++ sequence

OK
AT          //C24 is in Command mode
OK
ATO        //Returning to Data mode
CONNECT
```

## +COLP, Connected Line Identification Presentation

This command gets and changes the current setting of the Calling Line Presentation. When this command is enabled (and the called subscriber permits it), the following intermediate result code is returned:

**+COLP:** <number>,<type>,<alpha>.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+COLP=&lt;n&gt;</b>	<b>OK</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command enables/disables the display of the COL at the TE on the C24.
<b>Test</b>	<b>+COLP=?</b>	<b>+COLP: (list of supported &lt;n&gt;s)</b> <b>+CME ERROR: &lt;err&gt;</b>	The Test command displays the supported values of <n>.

The following table shows the +COLP parameters.

**Table 3-13: +COLP Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	Sets/displays the result code presentation status of the C24. 0     Disable (default) 1     Enable
<b>&lt;number&gt;</b>	Sets the phone number, using the format specified by <type>.
<b>&lt;type&gt;</b>	129    Unknown 145    International (used when dialing string includes "+" international access code character)
<b>&lt;alpha&gt;</b>	An optional, string-type, alphanumeric representation of <number> corresponding to the entry found in the phonebook. The character set is defined by +CSCS ( <a href="#">Refer to "+CSCS, Select Terminal Character Set", page 3-5</a> ).

### Example

```
AT+COLP=1
OK
atdl
+COLP: "0541234567",129,"Nir"
OK
```

## +CSO, Specify the Service Option

This command specifies the preferred service to be requested for the next originated packet call.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CSO=<SO>	On Error: <err> On Success: <OK>	Sets the C24 service option preferred for mobile originating (MO) packet calls. HEX values are NOT SUPPORTED.
<b>Read</b>	AT+CSO?	+CSO: <SO>	Returns error for unsupported values. Reads the current setting. By default the value is 1x data (so 33).
<b>Test</b>	AT+CSO=?	+CSO: (list of supported <SO>s)	

The following table shows the +CSO parameters.

**Table 3-14: +CSO Parameters**

<Parameter>	Description
<SO>	The following service option is supported: 0x21(33 dec) for 1x data.

## +MDC, Selection of Desired Message to Be Displayed Upon Connection of a Voice Call

This AT command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party. The OK and CONNECT messages are available.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MDC=<mode>	OK or: ERROR	The Set command selects which of the supported messages will be displayed upon connection of a voice call. Default Values: Power Up - As previously 0 - Before Set command is first used
<b>Read</b>	+MDC?	++MDC: <mode>	The Read command should return the current selection of <mode>.
<b>Test</b>	+MDC=?	+MDC: (list of supported <mode>s) OK	The Test command returns the possible <mode> values.

The following table shows the +MDC parameters.

**Table 3-15: +MDC Parameters**

<Parameter>	Description
<mode>	0 - Display OK on voice call connection. 1 - Display CONNECT on voice call connection.

## +MFIC, Filtering Incoming Calls

This command instructs the C24 to query or set Filtering Incoming voice Calls parameters.

This will limit incoming calls to ONLY contacts stored in phone books. If entries are NOT stored in the selected phone book the incoming voice call will be rejected therefore the phone must not indicate for an incoming call.

When in emergency mode, ALL calls MUST be permitted inbound.

+MFIC parameters are saved after power cycle.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MFIC=<state>[,<pb>]	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The set command defines the Incoming Calls Filtering parameters - this command enable/disable the filtering and set the search phonebook.
<b>Read</b>	+ MFIC?	+MFIC=<state>[,<pb>] <b>OK</b>	The read command returns the current MFIC set parameters value.
<b>Test</b>	+ MFIC=?	+MFIC: (list of supported <state>s),(list of supported <pb>s) <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The test command returns the possible ranges of MFIC parameters.

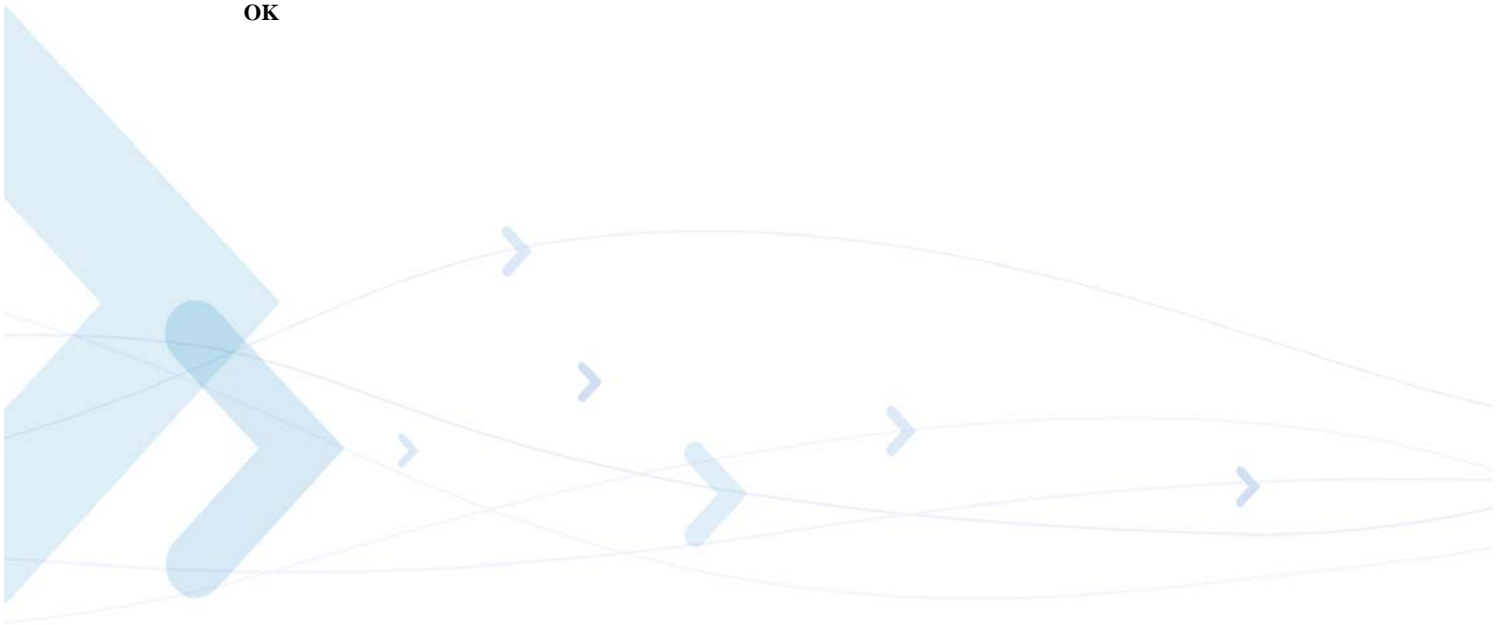
The following table shows the +MFIC parameters.

**Table 3-16: +MFIC Parameters**

<Parameter>	Description
<state>	This parameter holds the state of the feature: 0 Filtering is enabled 1 Filtering is disabled (default value)
<pb>	Sets the phonebook to be searched when there is an incoming call: RM Search will be done on R-UIM phonebook only (Default). ME Search will be done on C24 internal phone book only. MT Search will be done on both C24 internal and R-UIM phone books. <b>Note:</b> In case R-UIM is not present, selecting <pb>="RM" will return an error.

### Example

```
AT+MFIC=?  
+MFIC: (0-1),("RM","ME","MT")  
OK  
AT+MFIC=0,"RM"           // Enable filtering R-UM phone book.  
OK  
AT+MFIC?  
+MFIC: 0,"RM"           // Read MFIC parameters  
OK  
AT+MFIC=1                 // Disable the MFIC feature.  
OK  
AT+MFIC?  
+MFIC: 1                 // Read MFIC parameters.  
OK
```





## +MFOC, Filtering Outgoing Calls

This command instructs the C24 to query or set Filtering Outgoing Calls parameters.

This will limit the outgoing voice calls to ONLY contacts stored in the address book.

Numbers will NOT be permitted to be dialed that do NOT match 7, 10, or 11 digits to the address book.

Numbers that do NOT match 7, 10, or 11 digits to the address book, will not be permitted to be dialed.

This MUST also allow emergency and special numbers for outgoing calls.

+MFOC parameters are saved after power cycle.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MFOC=<state>[,<pb>]	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The set command defines the Outgoing Calls Filtering parameters - this command enable/disable the filtering and set the search phone book.
<b>Read</b>	+ MFOC?	+MFOC=<state>[,<pb>] <b>OK</b>	The read command returns the current MFOC set parameters value.
<b>Test</b>	+ MFOC=?	+MFOC: (list of supported <state>s),(list of supported <pb>s) <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The test command returns the possible ranges of MFOC parameters.

The following table shows the +MFOC parameters.

**Table 3-17: +MFOC Parameters**

<Parameter>	Description
<b>&lt;state&gt;</b>	This parameter holds the state of the feature: 0     Filtering is enabled 1     Filtering is disabled (default value)
<b>&lt;pb&gt;</b>	Sets the phonebook to be searched when there is an incoming call: RM    Search will be done on R-UIM phonebook only. ME    Search will be done on C24 internal phone book only (Default). MT    Search will be done on both C24 internal and R-UIM phone books. <b>Note:</b> In case R-UIM is not present, selecting <pb>="RM" will return an error.

### Example

```
AT+MFOC=?
```

```
+MFOC: (0-1),("RM","ME","MT")
```

```
OK
```

```
AT+MFOC=0,"RM"
```

```
// Enable filtering R-UIM phone book.
```

```
OK
```

```
AT+MFOC?
```

```
+MFOC: 0,"RM"
```

```
// Read MFOC parameters
```

```

OK
AT+MFOC=1           // Disable the MFOC feature.
OK
AT+MFOC?
+MFOC: 1           // Read MFOC parameters.
OK

```

## Supplementary services

### +MAIF, Motorola Air Interface Flash

This command allows the user to manage a supplementary services (Call Waiting, 3-way call, Conference Calls etc.) while MS is in a call by sending an air interface Flash with or without Information message (IM) to the BS.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MAIF[=<IM>]	<b>OK</b> //returned if Flash message has been successfully sent. <b>+CME ERROR: &lt;err&gt;</b>	The command is possible during a call only.

The following table shows the +MAIF parameters.

**Table 3-18: +MAIF Parameters**

<Parameter>	Description
<IM>	<b>Information Message</b> may include a Feature code (FC), digits (0-9) and End Marks (*, #) that identify the feature to be activated/deactivated/managed, along with any additional PIN information, called party number, etc.

**Note:** Flash sent to the Base Station is not 100% guaranteed because there is no confirmation from the Base Station.

### +CLIP, Calling Line Identification Presentation

Calling Line Identification Presentation (CLIP) provides the name identification of the calling party (e.g., personal name, company name, "restricted", "not available") to the called subscriber. The Calling Line Identification (CLI) may be provided to the terminating network by the originating network or the terminating network may retrieve it or derive it using the Calling Line Identification (CLI) which is generally provided to the terminating network from the originating network. The CLI is considered public when presentation of the calling name is allowed and private when presentation of the calling line is restricted.

#### Activation

CLIP may be activated by a Demand Activation authorized subscriber specifying a feature code (FC), as in:

```
AT+CDV*<FC>
```

## De-activation

CLIP may be de-activated by a Demand Activation authorized subscriber specifying a feature code, as in:

**AT+CDV\***<FC>**0**

+CLIP command controls the Calling Line Identification (CLI) presentation indication to the terminal when an incoming call is detected by the C24.

This command allows the user to query the provisioning status of the CLI by the C24. The command also allows the user to enable/disable the CLI presentation by the C24 to the terminal.

+CLIP: Response is returned after every RING or +CRING: sent from the ME to the TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CLIP= <b>&lt;n&gt;</b>	<b>OK</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command enables or disables the presentation of the CLI indication from the C24 to the terminal.
<b>Read</b>	AT+CLIP?	<b>+CLIP: &lt;n&gt;</b> <b>OK</b>	The Read command returns the +CLIP enable/disable state in the C24.
<b>Test</b>	AT+CLIP=?	<b>+CLIP: (0,1)</b>	The Test command returns the Set command options (0,1).

## +CLIP Indication

When the CLI presentation indication is enabled by the C24 (**<n>**=1), this unsolicited indication is sent to the terminal after the RING indication.

**+CLIP: <number>, <type>[, <subaddr>, <satype>[, <alpha>][, <CLI validity>]]]**

The following table shows the +CLIP parameters.

**Table 3-19: +CLIP Parameters**

<b>&lt;Parameter&gt;</b>	<b>Description</b>
<b>&lt;n&gt;</b>	Enables/disables the CLI presentation indication after the ring indication: 0     Disable CLI presentation 1     Enable CLI presentation The default is 0.
<b>&lt;"number"&gt;</b>	Calling line number. The number format is specified by <type>. If Calling line number is restricted by opposite part or is not available. "ID restricted" or "ID unavailable" will replace the number.
<b>&lt;type&gt;</b>	Type of address octet in integer format: 145    Default when the dialing string includes the international access code character "+". 129    Default when making a local call. 128    Type of number is unknown (usually the output when the number itself is unknown).
<b>&lt;subaddr&gt;</b>	NULL, field not used (String type subaddress of format specified by <satype>)

**Table 3-19: +CLIP Parameters (Cont.)**

<Parameter>	Description
<satype>	Field not used. Value is always 128 (unknown) - type of sub address octet in integer format.
<"alpha">	Name of the calling party (if provided by the network or if the number is found in the C24 phone books).
<CLI validity>	The Validity of the Calling Line Identity presentation: 0 CLI valid. 1 CLI has been withheld.
<redirection>	In case of call forwarding, this parameter indicated if the call come directly form the forwarding party or the call is redirected from other party. 0 Call comes directly from calling party. 1 Call is re-directed from other party.

**Example**

```

AT+CLIP=?
+CLIP: (0,1)           //CLI presentation is disabled by the C24 (0) and is enabled by the
network (1)
OK
AT+CLIP=1
OK
Example +CLIP indication:
(...incoming call...)
RING
+CLIP: "2173845400",129,,128,"Doe John",0
Example +CLIP indication with restricted CLI:
AT+CRC=1
OK
(...incoming call..., caller restricted the CLI presentation (used AT+CLIR)...)
+CRING: VOICE
+CLIP: " ID restricted ",128,,128,"",1

```

**+CCWA, Call Waiting Command**

Call Waiting (CW) provides notification to a subscriber of an incoming call while the subscriber is in the Conversation State. Subsequently, the subscriber can either answer or ignore the incoming call. If the subscriber answers the second call, may alternate between the two calls.

**Activation**

CW may be activated by a Demand Activation authorized subscriber specifying a feature code (FC), as in:

```
AT+CDV*<FC>
```

**De-Activation**

CW may be de-activated by a Demand Activation authorized subscriber specifying a feature code, as in:

```
AT+CDV*<FC>0
```

### Temporary Cancellation During a Call

CW may be canceled during a single call by a Demand Cancellation authorized subscriber:

**AT+MAIF=\*<FC>0**

### Management of Call Waiting

The second call (Call Waiting call) may be answered by MS, as in:

**AT+MAIF**

The MS may alternate between the two calls, as in:

**AT+MAIF**

Or release an active call, as in

**ATH**

Alert indication (RING) is applied to the controlling subscriber for held/waiting recall.

+CCWA command controls the Call Waiting indication, including the settings and the queries of the C24. When the Call Waiting indication is enabled by the C24 and there is a waiting call, an unsolicited +CCWA: indication is sent from the C24 to the terminal.

Action	Syntax	Response	Remarks
<b>Set</b>	+CCWA = <n>	If value is legal: <b>OK</b> If value is illegal: <b>+CME ERROR: &lt;err&gt;</b>	Enables/disables the call waiting unsolicited reporting).
<b>Read</b>	+CCWA?	+CCWA: <n> <b>OK</b>	The Read command returns the enable/disable status of the call waiting indication in the C24 (<n>).
<b>Test</b>	+CCWA=?	+CCWA: (list of supported <n>s)	The Test command returns <n> values supported by the C24 as a compound value.

### +CCWA Indication

When a call-waiting indication is enabled by the C24 (<n>=1), the following unsolicited indication is sent to the terminal from the C24:

**+CCWA: <number>, <Type>, <Class><alpha>**

The following table shows the +CCWA parameters.

**Table 3-20: +CCWA Parameters**

<Parameter>	Description
<n>	Enables/disables the call waiting indication to the terminal by the C24. 0 - Disable 1 - Enable The default is 0.
<"number">	Calling line number. The number format is specified by <type>.

**Table 3-20: +CCWA Parameters (Cont.)**

<Parameter>	Description
<type>	Type of address octet in integer format: 145 - Default when the dialing string includes the international access code character "+". 129 - Type of number is unknown (usually the output when the number itself is unknown)
<class>	1 - Voice.
<"alpha">	Name of the calling party if the number is found in the C24 phone books.

**Example**

```

AT+CCWA=1                //Enable call waiting indication on C24
OK
AT+CCWA=?
+CCWA: (0,1)
OK
AT+CCWA?
+CCWA: 1
OK

```

**Example +CCWA indication**

```

atd9311234567;           //Originate a voice call
OK
                           //Voice call connected
(...conversation...)
(... call waiting indication received by the C24 ...)
+CCWA: "046750227",129,1,"Nir" // incoming waiting call
+CCWA: "046750227",129,1,"Nir" // incoming waiting call
+CCWA: "046750227",129,1,"Nir" // incoming waiting call
+CCWA: "046750227",129,1,"Nir" // incoming waiting call
AT+MAIF                  // accept waiting call. The 1st call is placed to hold
OK
AT+MAIF                  // the 1st call is resumed, the 2nd is held
OK

```

**Three Way Calling (3WC)**

Three Way Calling provides the controlling subscriber the capability of adding a third party to an established two-party call, so that all three parties may communicate in a call. If either of the two non-controlling parties in an established three-party call disconnects, the remaining party is reconnected to the controlling subscriber as a normal two-party call. If the controlling subscriber of a three-party call disconnects, all other parties are released.

While in a call (1<sup>st</sup> party), the MS may requests a three-way calling by sending a Flash with Information message to the BS, as in:

```
AT+MAIF=<destination number 2nd party>.
```

This message automatically puts the 1<sup>st</sup> party on hold.

A call is established to the third party address. When the call is answered, the MS may establish the three-way call by sending a Flash to the BS, as in:

**AT+MAIF**

Or release the 2<sup>nd</sup> party, as in:

**AT+CHV**

Alert indication (RING) is applied to the controlling subscriber for held recall.

Once a Tree Way Call is established, the MS may disconnect the 2<sup>nd</sup> party, as in:

**AT+MAIF**

Or End call, as in:

**AT+CHV**

## Conference Calling (CC)

Conference Calling (CC) provides a subscriber with the ability to have a multi-connection call, i.e., a simultaneous communication between three or more parties (conferees).

If any of the conferees to a conference call disconnects, the remaining parties remain connected. If the controlling subscriber of a conference call disconnects, the conference circuit and all conferees are released. CC remains in effect until the controlling subscriber disconnects.

The controlling party may drop the conferee connected the shortest time with the "drop last party" feature code. Any number of conferees may be dropped this way. The conference call terminates when no other conferee remains.

CC does not impact a subscriber's ability to originate calls.

### Authorization

CC may be generally available or may be provided after prearrangement with the service provider.

The subscription parameters may include the maximum number of conferees allowed in a subscriber's conference call. The maximum number of conferees in any conference call is also dependent upon the local service provider.

### Invocation

#### Invocation with a Call Setup Request

CC may be invoked by an authorized subscriber concurrently with a call setup request with the following command:

**AT+CDV\*<FC>#< termination address >**

Alternatively:

**AT+CDV\*<FC>< termination address >**

is possible, if a fixed length invocation feature code is distinct from the drop last party invocation feature code.

#### Invocation within a Two-Way Call

CC may be invoked from within a two-way call by an authorized subscriber (with or without a preceding flash request) followed by one of the following commands:

**AT+MAIF=\*<FC>**

or

**AT+MAIF**=\*<FC>#<termination address>

Alternatively:

**AT+MAIF**=\*<FC><termination address>

is possible, if a fixed length invocation feature code is distinct from the drop last party invocation feature code.

### Adding a Party to a Conference Call

Once invoked, CC remains invoked until the controlling subscriber disconnects.

Additional parties may be added with one of the following commands:

**AT+MAIF**=<termination address>

or

**AT+MAIF**=\*<FC>#<termination address>

Alternatively:

**AT+MAIF**=\*<FC><termination address>

is possible, if a fixed length invocation feature code is distinct from the drop last party invocation feature code.

Those commands automatically put all the active conferees on hold.

A call is established to the next party address. When the call is answered, the following command:

**AT+MAIF**

connects the new conferee to the CC and makes CC active by sending a Flash to the BS.

### Drop Last Party Invocation within a Conference Call

The conferee most recently added to a conference call may be dropped from within the call or after placing the call on hold, by the controlling subscriber specifying the "drop last party" feature code, as in:

**AT+MAIF**=\*<FC>0

Alternatively:

**AT+MAIF**=\*<FC><termination address>

is possible, if a fixed length drop last party invocation feature code is distinct from the conference invocation feature code.

### End Conference Call

If connection is established between the controlling subscriber and one or more conferees (Active CC) the following command:

**AT+CHV**

Releases the call and disconnects all the conferee.

If there are conferees on hold and controlling subscriber is alerting a new party or the controlling subscriber is in a two-way conversation with a new party (Held CC) the following command:

**AT+CHV**

Releases the new party call and Alert indication (RING) is applied to the controlling subscriber for held conference recall.



## Call Forwarding (CF)

Call Forwarding (CF) permits a called subscriber to have the system send incoming calls addressed to the called subscriber's Directory Number to another Directory Number (forward-to number) or to the called subscriber's designated voice mail box. A subscriber may select a forward-to number termination address when the subscriber registers the CF.

CF may be generally available or may be provided after pre-arrangement with the service provider.

### Registration

If the subscriber is authorized for Fixed Registration, the forward-to number shall be registered upon authorization.

CF may be registered by a Variable Registration authorized subscriber specifying the CFB registration feature code and a forward-to number termination address or voice message system Modifier Digit 8, as in:

#### Idle mode

**AT+CDV\**<FC>**<termination address>***

or

**AT+CDV\**<FC>*8** (Voice message system).

#### While in a call

**AT+MAIF=\**<FC>**<termination address>***

or

**AT+MAIF=\**<FC>*8** (Voice message system).

**Note:** Registration associates the subscriber with the termination address as a forward-to number or with a particular voice mail box on a voice message system. Voice mail box passwords are registered separately with the voice message system.

### De-Registration

CF may be de-registered upon de-activation (at the home service provider option).

If the de-registration is to be separate from de-activation, the de-registration feature code must be distinct from the corresponding de-activation feature code.

CF may be de-registered by a Variable Registration authorized subscriber specifying the CF de-registration feature code, as in:

#### Idle mode

**AT+CDV\**<FC>*0**

#### While in a call

**AT+MAIF=\**<FC>*0**

CF shall be de-registered upon de-authorization.

### Activation

If the subscriber is authorized for Permanent Activation, CF shall be activated upon authorization.

CF may be activated upon registration for Demand Activation authorized subscribers.

CF may be activated upon registration for Variable Registration authorized subscribers.

A previously registered CF forward-to number may be activated by a Demand Activation authorized subscriber specifying a CF activation feature code, as in:

**Idle mode**

**AT+CDV\*<FC>**

**While in a call**

**AT+MAIF=\*<FC>**

**Note:** The serving system may provide a courtesy call to the forward-to number shortly after this feature is activated permitting the subscriber to verify the validity of the forward-to number.

**De-Activation**

CF may be de-activated by a Demand Activation authorized subscriber specifying the CF de-activation feature code, as in:

**Idle mode**

**AT+CDV\*<FC>0**

**While in a call**

**AT+MAIF=\*<FC>0**

CF shall be de-activated upon de-authorization or de-registration.

**Possible reasons for Call Forwarding**

- **Busy (CFB)** - when the subscriber is engaged in a call or service.
- **Default (CFD)** - when the subscriber is engaged in a call, does not respond to paging, does not answer the call or is otherwise inaccessible (including no paging response, the subscriber's location is not known, the subscriber is reported as inactive, Call Delivery not active for a roaming subscriber, Do Not Disturb active, etc.).
- **No Answer (CFNA)** - when the subscriber fails to answer, or is otherwise inaccessible (including no paging response, the subscriber's location is not known the subscriber is reported as inactive, Call Delivery not active for a roaming subscriber, Do Not Disturb active, etc.). CFNA does not apply when the subscriber is considered to be busy.
- **Unconditional (CFU)** - calls are forwarded regardless of the condition of the termination.

**+CLIR, Calling Line Identification Restriction**

Calling Line Identification Restriction (CLIR) restricts presentation of the calling subscriber's name to the called party. CLIR may be generally available or may be provided after pre-arrangement with the service provider.

+CLIR command instructs the C24 to query, enable or disable the presentation of the CLI (calling line ID) of a MO call to the called party in a variable CLIR network mode.

CLI can be permanently restricted by the operator which makes CLIR command will not able to control CLI restriction.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+CLIR=&lt;n&gt;</b>	<b>OK</b>	The Set command instructs the C24 to enable/disable CLI restriction for all MO calls. Note: the appropriate Feature Code (FC) may be added to dial string of MO call as a result of +CLIR settings.
<b>Read</b>	<b>+CLIR?</b>	<b>+CLIR:&lt;n&gt;</b> <b>OK</b>	The Read command returns the current setting on the C24 <n>.
<b>Test</b>	<b>+CLIR=?</b>	<b>+CLIR: (list of supported &lt;n&gt;s)</b>	The Test command returns <n> values supported by the C24.

The following table shows the +CLIR parameters.

**Table 3-21: +CLIR Parameters**

<Parameter>	Description
<n>	Adjustment for outgoing calls 0 - Show ID CLI enabled 1 - Hide ID CLI disabled The default is 0.

#### Example

```

AT+CLIR=?
+CLIR: (0,1)
OK
AT+CLIR?
+CLIR: 0
OK
AT+CLIR=1
OK

```

## Call Status Messages

### +CPAS, Phone Activity Status

This command displays the current activity status of the C24, for example, call in progress, or ringing.

Command Type	Syntax	Response/Action	Remarks
<b>Execute/Read</b>	AT+CPAS AT+CPAS?	+CPAS: <pas> <b>OK</b> or: +CME ERROR: <err>	The Execute and Read commands return the activity status <pas> of the C24. They can be used to interrogate the C24.
<b>Test</b>	AT+CPAS=?	+CPAS: (list of supported <pas>s) <b>OK</b> or: +CME ERROR: <err>	

The following table shows the +CPAS parameters.

**Table 3-22: +CPAS Parameters**

<Parameter>	Description
<pas>	0 - Ready - The C24 allows commands from the terminal 3 - Ringing (MT calls) - The C24 is ready for commands from the terminal, but the ringer is active 4 - Call in progress - The C24 is ready for commands from the terminal, but a call is in progress

### Example

```

AT+CPAS
+CPAS: 0
OK
AT+CPAS=?
+CPAS: (0,2-4)
OK
AT+CPAS?
+CPAS: 4
OK
AT+CPAS //Voice call active state
+CPAS: 4
OK

```

## +CLCC, List Current Calls

This command displays a list of current C24 call status, and also enables/disables the unsolicited indication of the call list.

If the command succeeds but no calls are available, no information response is sent to the terminal.

+CLCC will indicate only the real state of call party (traffic channel).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CLCC=<state>	OK or: +CME ERROR: <err>	The Set command enables/disables unsolicited indications.
<b>Execute</b>	AT+CLCC	+CLCC: <idx>,<dir>,<call state>, <mode>, <mpty>[,<number>,<type>,<alpha>] [<CR><LF>+ CLCC: <idx>,<dir>,<call state>, <mode>,<mpty>[,<number>,<type>,<alpha>] [...]] OK	The Execute command enables the receiving of data about current calls.
<b>Read</b>	AT+CLCC?	+CLCC: <state> OK or: +CME ERROR <err>	The Read command returns the call status.
<b>Test</b>	AT+CLCC=?	+CLCC: (List of supported <state>s) OK or: +CME ERROR <err>	

### Notes:

- In case that a Call Waiting appears, the <index> of waiting party will be 2.
- If +MAIF command is executed during an active call, the other call party may be added, switched or released.

Due to no network indications for the action above, the +CLCC report will be as follows:  
+CLCC: <idx>,<dir>,<call state>, <mode>, <mpty>, without <number> and <alpha> since +MAIF command was used.

The following table shows the +CLCC parameters.

**Table 3-23: +CLCC Parameters**

<Parameter>	Description
<state>	0     Disable CLCC unsolicited indication 1     Enable CLCC unsolicited indication The default value is 0.
<idx>	Integer type, call identification number. Always 1 except the Waiting Call Party appears. <idx>=2 for the Waiting Call Party.
<dir>	0     Mobile originated call (MO) 1     Mobile terminated call (MT)
<call state>	The state of the call 0     Active 1     Not in use 2     Dialing (MO call) 3     Not in use 4     Incoming (MT call) 5     Waiting (MT call) 6     Released
<mode>	Bearer/Teleservice 0     Voice Call 1     Data 2     Fax
<mpty>	Multiparty status 0     Always 1     Not in use
<number>	Phone number in the format specified by <type>. Contains a string of up to 32 characters.
<type>	Phone number display format. Type of address octet in integer format (refer to GSM 04.08 [8] subclause 10.5.4.7) 129     Local number 145     International number with access character +
<alpha>	Text representation of the phone book entry. String type alphanumeric representation of <number> corresponding to the entry found in the phone book. Contains a string of up to 20 characters.

**Note:** When a mobile-originated call is routed to PSTN (PABX), no ALERT indication is prompted.

#### Example

```
AT+CLCC=?
+CLCC: (0,1)
OK
AT+CLCC           // in Idle
OK
```

```

AT+CLCC                                // during active call
+CLCC: 1,0,0,0,0,"01256316830",129,"Mike"
OK
AT+CLCC?
+CLCC: 0
OK
AT+CLCC=1                              //Example with unsolicited indication
OK
AT+CLCC?
+CLCC: 1
OK
ATD055490698;
OK
+CLCC: 1,0,2,0,0,"055490698",129,"Alpha"
OK
+CLCC: 1,0,0,0,0,"055490698",129," Alpha "
at+chv
NO CARRIER
OK
+CLCC: 1,0,6,0,0,"055490698",129," Alpha
//Example with +MAIF interaction (CW):
atd035658222;
OK
+CLCC: 1,0,2,0,0,"035658222",129,""
OK
+CLCC: 1,0,0,0,0,"035658222",129,""
+CLCC: 2,1,5,0,0,"0506416704",129,"" //Call Waiting is arrived
+CCWA: "0506416704",129,1,"c"
+CCWA: "0506416704",129,1,"c"
+CCWA: "0506416704",129,1,"c"
AT+MAIF                                // waiting call accepted
OK

// from this point till call release no +CLCC unsolicited reports
// appear (except the new CW case)

AT+CLCC
+CLCC: 1,0,0,0,0
OK
AT+MAIF
OK
AT+CLCC
+CLCC: 1,0,0,0,0
OK
at+chv
+CLCC: 1,0,6,0,0
NO CARRIER
OK

//Example with +MAIF interaction (3-way):
atd035658222;
OK
+CLCC: 1,0,2,0,0,"035658222",129,""
OK
+CLCC: 1,0,0,0,0,"035658222",129,""

```

```

AT+MAIF=0507778889      // 2nd call party
OK

                        // from this point till call release no +CLCC unsolicited reports
                        appear (except the new CW case)

AT+CLCC
+CLCC: 1,0,0,0,0
OK
AT+MAIF                  // 3-way call
OK
AT+CLCC
+CLCC: 1,0,0,0,0
OK
at+chv
+CLCC: 1,0,6,0,0
NO CARRIER
OK

```

## +MCST, Call Status Messages

This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MCST=<n>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command Enables/disables the unsolicited call status messages.
<b>Read</b>	+MCST?	<b>+MCST: &lt;state&gt;</b> <b>OK</b>	The Read command returns the current call processing state.

### +MCST Indication

When a change in call state occurs and the +MCST is set to n=1 the C24 will give the following indication:

```
+MCST: <state>
```



The following table shows the +MCST parameters.

**Table 3-24: +MCST Parameters**

<Parameter>	Description
<n>	0 - Disable MCST unsolicited indication 1 - Enable MCST unsolicited indication
<state>	1 - Idle call state 2 - Single incoming call 3 - Single call active 4 - Multi-party call active 5 - Single call held 10 - Single active call plus call waiting 17 - Call control busy 64 - Calling 68 - No Service 69 - No Redial 72 - Security Fail

#### Example

```

AT+MCST?
+MCST: // <idle>
AT+MCST=1
OK
atd035684423;
+MCST: 17
OK
+MCST: 17
+MCST: 255
OK
+MCST: 3
+MCST: 17
NO CARRIER
+MCST: 1

```

## +MVPRI, Voice Privacy

This command sets the voice privacy.

The user voice transmitted over a CDMA Traffic Channel is afforded a modest degree of protection against eavesdropping over the air.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+MVPRI=&lt;type&gt;,&lt;privacy&gt;</b>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	When privacy is successfully enabled or disabled, an unsolicited report will display: "Private On/Off".
<b>Read</b>	<b>+MVPRI?</b>	<b>+MVPRI: &lt;privacy&gt;</b> <b>OK</b>	
<b>Test</b>	<b>+MVPRI=?</b>	<b>+MVPRI: (list of supported &lt;type&gt;s),(list of supported &lt;privacy&gt;s)</b> <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	

The following table shows the +MVPRI parameters.

**Table 3-25: +MVPRI Parameters**

<Parameter>	Description
<b>&lt;type&gt;</b>	0 - Write to NV, applicable for next call (default) 1 - Send request to BS, applicable for current call (only valid when voice call is active)
<b>&lt;privacy&gt;</b>	0 - Voice privacy off (default) 1 - Voice privacy on

## +MECALL, E-call Indication

This unsolicited report sends indication of an emergency call to the terminal.

In addition, the command enables/disables the C24 to provide an alert tone on the alert audio path after the user dials the emergency number.

This command is defined for Verizon operator.

This command defines the +MECALL operation.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MECALL=<mode>	OK  or:  ERROR: <error_code>	<mode> control the alert tone while the report is always enable.
<b>Read</b>	+MECALL?	+MECALL: <mode> OK  or:  ERROR: <error_code>	
<b>Test</b>	+MECALL=?	+MECALL: <list of supported mode> OK  or:  ERROR: <error_code>	
<b>Unsolicited report</b>	+MECALL: "EMERGENCY CALL"		The C24 sends the text EMERGENCY CALL to the terminal.

The following table shows the +MECALL parameters.

**Table 3-26: +MECALL Parameters**

<Parameter>	Description
<mode>	0 - Disable (Default) 1 - Enable

## Emergency Services (E-Calls)

### Common operation

#### Basic Requirements

**Note:** The information given here is using the most common used emergency number (911). In some countries the number may be different, and C24 should behave identically for these numbers.

Emergency Services (911) permits a subscriber to dial using dialing AT commands (ATD, AT+CDV, AT+MAIF) and be connected to a Public Safety Answering Point (PSAP) to request an emergency response from the appropriate agency (e.g., fire, police, ambulance, poison control).

center, or suicide prevention center)1. The PSAP shall be the PSAP appropriate to the calling subscriber's current location.

A 911 call shall bypass any authorization restrictions or call origination restrictions features (e.g., Subscriber PIN Access (SPINA), Subscriber PIN Intercept (SPINI) features). The call shall automatically invoke Priority Access and Channel Assignment (PACA), and the call shall be given higher priority than normal calls.

Once the call is answered, the subscriber shall be able to communicate the type of emergency over a normal voice connection with the PSAP. (Encryption may be used over the air interface, but it must be removed on the connection to the PSAP.)

A 911 call does impact a subscriber's ability to originate or receive calls while the 911 call is in progress. Flash privileges (features controlled by activating the AT+CDV or AT+MAIF feature, such as, Call Waiting, Three-Way Calling, Conference Calling, and Call Transfer) are suspended during the 911 call, except to reconnect a call placed on hold to place the 911 call. When the 911 call is released, the subscriber's normal calling capabilities are restored. Release occurs when either the subscriber or PSAP disconnects.

### Applicability to Telecommunications Services

E-Call is applicable to voice and Teletype Devices for the Deaf (TDD) telecommunication services.

### Invocation of E-Call

- E-Call is invoked by the subscriber dialing sing dialing AT commands (ATD, AT+CDV, AT+MAIF). The sequence may be dialed while the MS is idle, while the MS is engaged in a call, or while the MS has a call on hold.
- If no air interface channels are available when E-Call is invoked, the request may be delayed by automatically invoking Priority Access and Channel Assignment (PACA) for a level appropriate for a subscriber dialing 911.
- When E-Call is invoked, the call is routed to the appropriate Public Safety Answering Point (PSAP). Routing decisions are based upon the current location of the invoking MS and possibly other factors, such as, the availability of a selective router, PSAP, or interconnecting trunks.
- If E-Call is invoked from within a call, the other party is placed on hold in a similar fashion to a subscriber attempt to invoke Three-Way Call (3WC) or Conference Call (CC).
- Once E-Call is invoked, the subscriber's normal flash privileges are suspended. If a call is on hold to make the E-Call, the held call can be joined to the E-Call in a Three-Way Call or Conference Call by the subscriber activating the AT+MAIF command. Once the call is joined, subsequent flash requests shall be ignored, until the call is released.

### Interactions with Other Wireless Services

#### Call Forwarding-All types - Busy, Default, No Answer, Unconditional

Calls from an authorized emergency service bureau should not be forwarded. The network may not be capable of identifying the call as originating from an emergency service bureau and normal call forwarding may be provided.

#### Call Transfer (CT)

If a subscriber with CT invokes E-Call during a call or with a call on hold (thereby seemingly invoking CT), transfer shall not take place if the controlling subscriber disconnects. Also, a flash

(an activation of the AT+MAIF command) while communicating with a PSAP is used to bridge the held party into the conversation rather than to disconnect the PSAP.

If 9-1-1 is invoked while idle, flash requests and attempts to a third number are ignored.

#### **Call Waiting (CW)**

CW is not possible once E-Call has been invoked.

If E-Call is invoked, subsequent incoming calls are ignored (unless the call is from a PSAP).

#### **Calling Number Identification Presentation & Restriction**

In cases where a calling subscriber has an arrangement that presentation of their CNI is marked presentation restricted, the serving MSC should deliver all available CNI information (including the presentation restricted indication) to the authorized emergency service bureaus.

#### **Conference Calling (CC)**

If a subscriber with CC invoked invokes E-Call for a call leg, or if a subscriber invokes the E-Call with a CC invocation feature code, the E-Call is allowed to proceed. A subsequent flash (an activation of the AT+MAIF) while communicating with a PSAP is used to bridge the held party(-ies) into the conversation. No additional parties may be added to the conference call. The PSAP cannot be dropped with the Drop Last Party feature code.

#### **Password Call Acceptance (PCA)**

Emergency Services takes precedence over PCA. A call to or from an authorized emergency service bureau should not be refused by PCA. The network may not be capable of identifying the call as originating from an emergency service bureau and normal PCA may be provided.

#### **Priority Access and Channel Assignment (PACA)**

An emergency services call shall automatically invoke the PACA feature when no air channels are available.

#### **Selective Call Acceptance (SCA)**

Emergency Services takes precedence over SCA. A call from an authorized emergency service bureau should not be refused by SCA. The network may not be capable of identifying the call as originating from an emergency service bureau and normal SCA may be provided.

#### **Subscriber PIN Access (SPINA)**

Emergency Services takes precedence over SPINA. Calls to an authorized PSAP shall not be denied while SPINA is active. A call from an authorized PSAP should not be denied while SPINA is active. The network may not be capable of identifying the call as originating from an emergency service bureau and normal SPINA may be provided.

#### **Subscriber PIN Intercept (SPINI)**

Emergency Services takes precedence over SPINI. A call to an authorized PSAP shall not invoke SPINI.

#### **Three-Way Calling (3WC)**

If a subscriber with 3WC invokes E-Call during a call or with a call on hold (thereby seemingly invoking 3WC), a flash (an activation of the AT+MAIF command) while communicating with a PSAP is used to bridge the held party into the conversation rather than to disconnect the PSAP. A subscriber disconnect with either AT+CHV or ATH commands before the PSAP answers, shall be treated to abandon the E-Call attempt. The subscriber shall be recalled for the held party.

## Verizon requirements for emergency services

### Emergency (911, \*911, #911) dialing

Devices supporting voice capabilities shall support the following dialing sequences:

- 911
- \*911
- #911
- Other numbers stored as Emergency Numbers in the device

Memory storage locations within the device shall not conflict with these sequence numbers in any way. Example: phonebook entries, etc.

### Emergency (911, \*911, #911) Call Processing

When an emergency number such as 911 is dialed, (manually dialed or any number stored in the Emergency Number memory storage is dialed) the call is processed by the mobile phone in the following way:

#### Emergency Call: Dialing

The phone must process the 911 or emergency call regardless of the System Select setting or the PRL list.

1. If the phone currently has service when the call is made, the call should be processed immediately on that system.
2. If the phone currently has NO service when the call is made, the phone should search for ANY SYSTEM available regardless of the System Select settings, PRL's and Negative SID lists.

#### Emergency Call: Terminated

If an emergency call is currently in progress and is then terminated (ended) by the user or the Network or the call is dropped due to signal related issues, the phone should:

1. Remain on the System that last served the call
2. Remain on the System, that last served the call, for a time period no less than 5 minutes after the termination of the 911 call. This allows for the 911 Public Service Access Point (PSAP) to call back if needed.
3. After the 5 minute time period, return to the normal operation of scanning for service.
4. During the 5 min. period, if the user changes the System Select, the phone should scan for that selection, even if there is no service.
5. During the 5 min. period, if the user places a call to a number, other than 911 and/or the emergency numbers stored in memory, the phone shall resume the normal operation of scanning for service using the system select and PRL.

#### Emergency Call: Weak Signal

If an emergency call is originated from the phone in a service area that has weak Signal:

1. The phone should use the standard Retry mechanism to process the call on the current system that the phone is on. This is to process the call as quick as possible.

- If the phone FAILS to process the call on the current system, the phone should scan for ANY available system and process the call. The phone should continue to make attempts to process the call until the call goes through or until user intervention.

### Emergency Call Drop

The device shall not automatically redial an emergency call if it has been dropped.

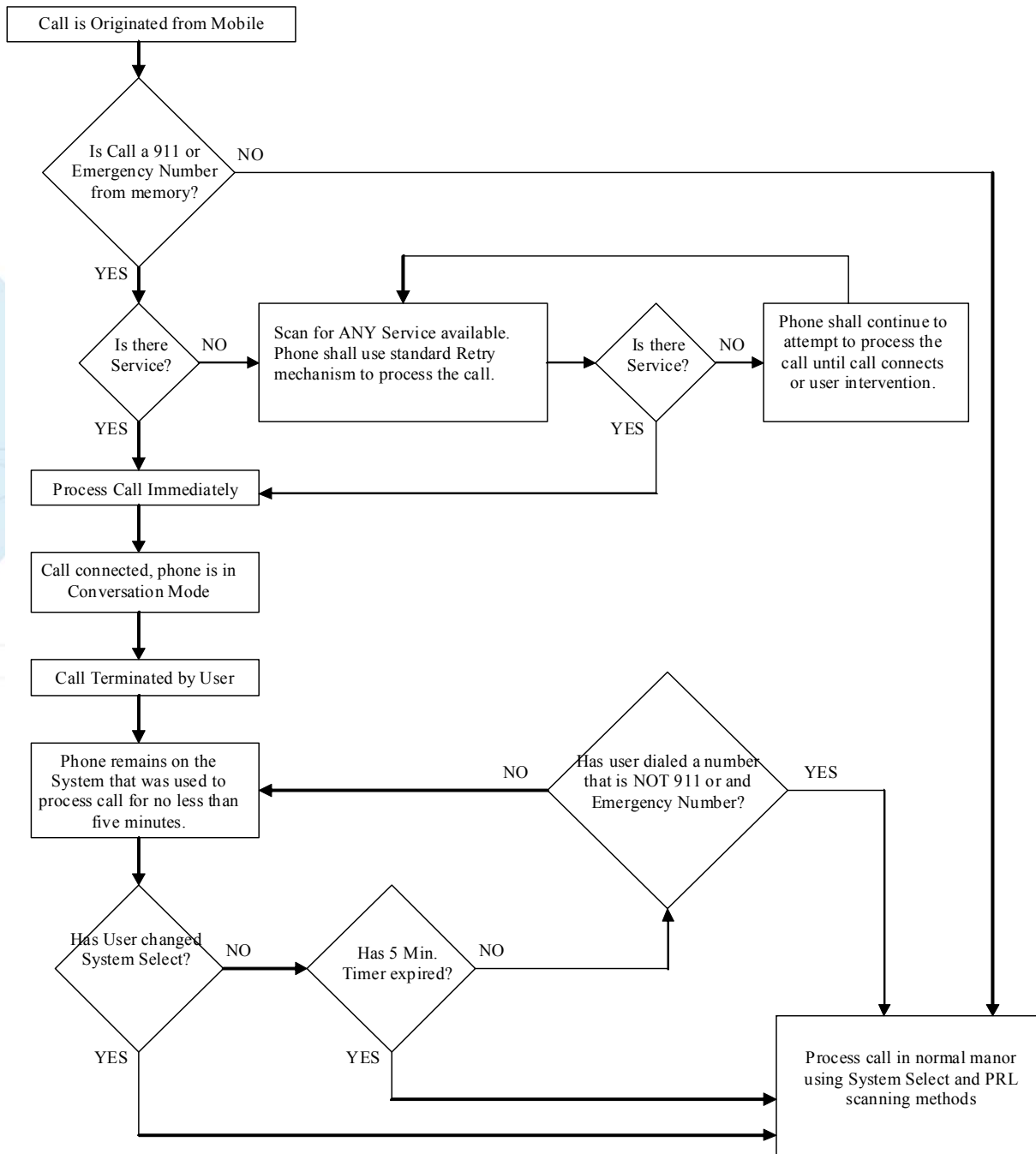


Figure 3-1: Verizon E-Call Handling Flowchart

## Interaction with Other Wireless Services

### OMA-DM

The device and/or OMA-DM client will be responsible to ensure that the device is in idle mode prior to starting a ppp session for the purposes of DM. Devices shall not attempt to initiate a DM data session until the emergency procedure is complete and they return to idle.

**Note:** The user cannot interrupt the update (including Emergency Calls). The device must complete the block-by-block update until it is complete before any key-presses/user interruptions will be recognized.

### SMS

Any emergency dial string, as defined in Emergency Dialing section of the Verizon Wireless Device Feature Definition/Requirements, that is embedded in an SMS/EMS message shall NOT be redialed.

### OTA

If the user enters the dial string associated with 911 calls, all OTA activities shall be suspended to initiate the emergency call process as soon as possible as defined in Verizon Wireless Device Feature Definition/Requirements.

### Data Session

If the user enters the dial string associated with 911 calls, all activities shall be suspended to initiate the emergency call process as soon as possible.

## Sprint Requirements for Emergency Services

### System Selection for Emergency Services

The Subscriber Equipment SHALL have a special 911 mode of operation. This mode SHALL be entered if a 911 emergency call is placed on Subscriber Equipment supporting voice service.

While in the 911 mode, the Subscriber Equipment SHALL be enabled to operate on any channel of which the device is capable, preferred or non-preferred, regardless of preference settings in the PRL.

While in this mode the Subscriber Equipment SHALL attempt to place the 911 call on the preferred CDMA carrier available as selected by the preferred roaming list in the Subscriber Equipment.

If the Subscriber Equipment fails to receive an adequate signal from a preferred carrier, the Subscriber Equipment SHALL attempt to complete the call via non-preferred CDMA carriers and SHALL continue to rescan and reattempt the call until it is established, the user terminates the call attempt, or the Subscriber Equipment loses power.

After the call has been established, the unit SHALL NOT rescan for better service until the 911 mode is exited.

The Subscriber Equipment SHALL be fully compliant with the FCC's Second Report and Order to improve the transmission of 911 calls (FCC 99-96 dated May 13, 1999) [64], and the Federal Communications Commission Code of Federal Regulation 47§ 22.921 [80].



## Emergency Numbers

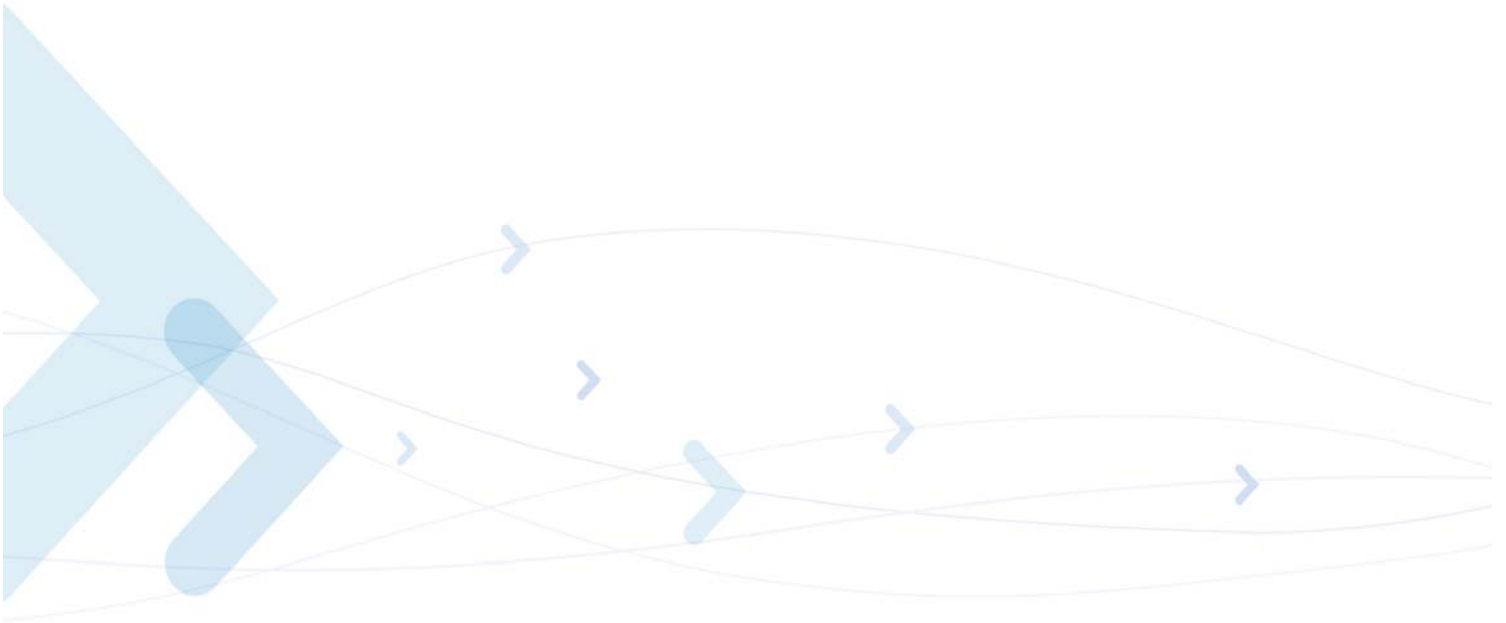
Emergency numbers **MUST** include 911, #911, and \*911.

Additional emergency numbers **MUST** be designated only through the UPST or through software coding.

Call origination with these numbers **MUST** put the subscriber terminal into emergency call mode.

Any outbound calls made in Emergency Mode **MUST** be tagged as "Emergency" in the call logs for their respective call type.

The user **MUST** always be able to dial 911 even C24 is locked.



## SMS

### Overview

A CDMA SMS message belongs to one of three message definitions:

- Point-to-point messages are for sending messages between phones. Such messages include addressing information and a structured data area, which can include fields that describe various message properties, as well as the user data (i.e. the message contents to display to the user).
- Acknowledge messages exist to pass status information. They simply contain a cause (error) code.
- Broadcast messages are sent from the network to all phones in a certain geographical area. They cannot be sent from a phone.

A point-to-point message can have a teleservice identifier to specify the application that should handle it. The standard defines the operation of six teleservices.

The Wireless Messaging Teleservice (WMT) is for short text messaging between users. The Wireless Enhanced Messaging Teleservice (WEMT) extends this to include EMS elements such as pictures. Outgoing messages of these two teleservices can be created. Incoming messages of these teleservices are stored in the message store.

Other teleservices defined are: IS-91 Extended Protocol Enhanced Services, Wireless Paging Teleservice (WPT), Voice Mail Notification (VMN), and Service Category Programming Teleservice (SCPT). Incoming WPT and VMN messages are stored in the message store.

The fields in a message depend on the teleservice being used, and the message type. The most important types are the Deliver type, which is used for a message sent to a phone, and the Submit type, which is used for a message sent from a phone. There are also the following types:

- Cancellation: from the phone to the Message Center to cancel a submitted message.
- User Acknowledgment: sent from a phone that has received a message to the submitter to inform it that the user has acknowledged the message.
- Delivery Acknowledgment: sent from the Message Center to inform the phone of the status of a submitted message.
- Read Acknowledgment Message: sent from a phone that has received a message to the submitter to inform it that the user has opened the message.

Incoming acknowledgement messages are handled automatically by messaging.

Not all teleservices use all message types: for example, WPT does not support message cancellation, so does not use the Cancellation message type.

The CDMA SMS 3GPP2 standard supplies tables of which fields apply to which teleservices and message types.

- The SMS feature provides means for SMS messages handling and the reporting of SMS reception events.
- Short messages can be written and displayed in various coding schemes.
- Reception of an incoming message can invoke an indication to the terminal. This feature is configurable using the command AT+CNMI. Short messages received during data calls are not indicated.
- Short messages can be sent and received simultaneously with Voice, Data and Fax calls.

- Cell broadcast messages can also be selected and received on the C24. The C24 enables registration to specific broadcast channels.
- C24 supports SMS PDU and SMS TEXT mode.

## SMS Commands

### +CSMS, Select Message Service.

This command handles the selection of the messaging service. It returns the types of messages that are supported by the C24.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CSMS=<service>	+CSMS: <mt>,<mo>,<bm> or: +CMS ERROR: <err>	The Set command sets the type of service and returns the types of messages supported by the C24.
<b>Read</b>	+CSMS?	+CSMS: <service>,<mt>,<mo>,<bm>	The Read command returns the supported message types along with the current service setting.
<b>Test</b>	+CSMS=?	+CSMS: <service>	The Test command returns a list of all the services supported by the terminal.

The following table shows the +CSMS parameters.

**Table 3-27: +CSMS Parameters**

<Parameter>	Description
<b>&lt;service&gt;</b>	Integer that defines the type of service 1-127 Not supported 128 Supported (manufacturer-specific)
<b>&lt;mt&gt;</b>	Mobile terminated messages 0 Not supported by the C24 1 Supported by the C24
<b>&lt;mo&gt;</b>	Mobile originated messages 0 Not supported by the C24 1 Supported by the C24
<b>&lt;bm&gt;</b>	Will be supported in future release.

**Note:** Only the 128 (manufacturer-specific) messaging service is supported by the C24. The service is supported for all messaging types (mobile terminated, mobile originated and broadcast).

**Example**

```

AT+CSMS=128
+CSMS: 1,1,1
OK
AT+CSMS?
+CSMS: 128,1,1,1
OK
AT+CSMS=?
+CSMS: (128)
OK

```

**+CPMS, Preferred Message Storage**

This command handles the selection of the preferred message storage area. The message storage area is divided into three parts, mem1, mem2 and mem3.

Currently:

The Inbox holds only incoming messages with Message-Type: SMS-DELIVER. The Draft folder holds messages with Message-Type: SMS-SUBMIT and message stat - STO-UNSENT. When a message from the Draft folder is sent, it is moved to the Outbox folder and the message stat is changed to STO-SENT.

In order to modify the command that it will act according to GSM 07.05 the following changes are needed:

**Storage handling:**

Storage Name	Saved in:	Supported <mem>	Number of Messages That Can Be Saved	Type of Messages That Can Be Saved in This Storage
"RM" - if R-UIM is presented. "IM" - if R-UIM is not presented.	R-UIM/NVM	<mem1> <mem3>	"RM" - According to R-UIM capacity. "IM" - 100 A new message is stored in the first free location, starting from 251.	SMS-DELIVER STATUS-REPORT SMS-SUBMIT (in case of reply/forward).
"ME" ME message storage	NVM	<mem1> <mem2>	All storages, associated with ME, shared the same range. A new message is stored in the first free location, starting from the last index that has been used.	SMS-SUBMIT SMS-COMMAND
"BM" Broadcast Messages	NVM	<mem1>	ME: 1-200 BM: 201-250	CBM - will be supported in future release.
"MT" All storages	NVM / R-UIM&NVM	<mem1>	"IM"+"ME"+"BM" or "RM"+"ME"+"BM"	All

- Lower case for inserted <mem>s will also be supported.

- This command will be a none basic command, which means the C24 module should reject the command with appropriate error message when the R-UIM is not presence (in model with R-UIM) and/or the phone is in lock state.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CPMS=<mem1>[,<mem2>[,<mem3>]]	+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3> OK or: +CMS ERROR: <err>	The Set command sets the memory storage.
<b>Read</b>	+CPMS?	+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3> OK or: +CMS ERROR: <err>	The Read command displays the selected memory storage type for the three memory areas.
<b>Test</b>	+CPMS=?	+CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s) OK +CMS ERROR: <err>	The Test command lists the supported memory storage for <mem1>, <mem2> and <mem3>.

The following table shows the +CPMS parameters.

**Table 3-28: +CPMS Parameters**

<Parameter>	Description
<mem1>	String type; memory from which messages are read and deleted. (commands List Messages +CMGL, Read Message +CMGR and Delete Message +CMGD).  <b>Supported values are:</b> "MT", "RM", "ME", "BM", "IM".  <b>Note:</b> "RM" - if R-UIM is presented. "IM" - if R-UIM is not presented.  <b>The default value AT power-up is</b> "MT".
<mem2>	String type; memory to which writing and sending operations are made. (commands Send Message from Storage +CMSS and Write Message to Memory +CMGW); refer <mem1> for defined values  <b>Supported value is:</b> "ME".  <b>The default value AT power-up is</b> "ME".
<mem3>	String type; memory to which received SMS are preferred to be stored (unless forwarded directly to TE; refer command New Message Indications +CNMI); refer <mem1> for defined values; <b>Note:</b> 1. Received CBMs are always stored in "BM" unless directly forwarded to TE; 2. Received status reports are always stored in "RM" or "IM" accordingly.  <b>Supported value is:</b> "RM" - if R-UIM is presented. "IM" - if R-UIM is not presented.  <b>The default value AT power-up is:</b> "RM" - if R-UIM is presented. "IM" - if R-UIM is not presented.
"BM"	Will be supported in future release.
"ME"	C24 message storage for Write and Send SMS
"MT"	Combined C24 and R-UIM message storage. <b>Note:</b> If R-UIM is not presented then "MT" = "ME"+"IM" If R-UIM is presented then "MT" = "ME"+"RM"
"RM"	R-UIM message storage for Received SMS
"IM"	C24 message storage for Received SMS

**Note:** The value 'Total' is the total number of messages, of maximal size, that can be stored in the corresponding 'mem': Total1 for mem1, Total2 for mem2, and Total3 for mem3.

### Example

```
AT+CPMS=?                // R-UIM is presented
+CPMS: ("ME","RM","MT","BM"),("ME"),("RM")
OK
AT+CPMS=?                // R-UIM is not presented
```

```
+CPMS: ("ME","IM","MT","BM"),("ME"),("IM")
OK
```

## +CMGF, Message Format

This command is a basic command. The Set command handles the selection of the message format used with send, list, read and write commands, as well as the format of unsolicited result codes resulting from message receipts. The C24 supports both PDU mode (where entire TP data units are used) and text mode (where the body of the message and its headers are given as separate parameters).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+CMGF=&lt;mode&gt;</b>	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	The Set command sets the message format to use.
<b>Read</b>	<b>+CMGF?</b>	<b>+CMGF:&lt;mode&gt;</b>	The Read command displays the current message format.
<b>Test</b>	<b>+CMGF=?</b>	<b>+CMGF:(list of supported &lt;mode&gt;s)</b>	The Test command lists all the supported message formats.

The following table shows the +CMGF parameters.

**Table 3-29: +CMGF Parameters**

<Parameter>	Description
<b>&lt;mode&gt;</b>	Message format: 0 PDU mode (default) 1 Text mode

### Example

```
AT+CMGF=1
OK
AT+CMGF?
+CMGF: 1
OK
AT+CMGF=?
+CMGF: (0,1)
OK
```

## +CSDH, Show Text Mode Parameters

This command controls whether detailed header information is shown in text mode result codes.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+CSDH=[&lt;show&gt;]</b>	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	The set command controls whether detailed header information is shown in text mode result codes.
<b>Read</b>	<b>AT+CSDH?</b>	<b>+CSDH: &lt;show&gt;</b> <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The read command returns the current <show> parameter value.
<b>Test</b>	<b>AT+CSDH=?</b>	<b>+CSDH: (list of supported &lt;show&gt;s)</b> <b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	

The following table shows the +CSDH parameters.

**Table 3-30: +CSDH Parameters**

<Parameter>	Description
<b>&lt;show&gt;</b>	0 - Means do not show header values defined in commands +CSMP and +CMGW 1 - Means show the values in result codes. For more information see description in +CMT,+CMGR/+MMGR,+CMGL/+MMGL sections



**Table 3-31: Show Text Mode Parameters according to +CSDH**

AT Command	AT+CSDH=0	AT+CSDH=1
<b>+CMGR/MMGR</b>	<b><u>SMS-SUBMIT</u></b>	
	<stat>,<ts>,<da>	<stat>,<ts>,<da>[,<toda>,<udh>,<lang>,<dc>,<tp>,<vp>][,<priority>][,<privacy>][,<cbn>][,<to>,<bn>][,<rpl>][,<mtp>][,<length>]
	<b><u>SMS-DELIVER</u></b>	
	<stat>,<ts>,<scts>,<oa>	<stat>,<ts>,<scts>,<oa>[,<tooa>,<udh>,<lang>,<dc>,<priority>][,<privacy>][,<cbn>][,<to>,<bn>][,<rpl>][,<mtp>,<length>]
	<b><u>Voice Mail Notification</u></b>	
	<stat>,<ts>,<scts>,<oa>	<stat>,<ts>,<scts>,<oa>[,<tooa>,<udh>,<dc>,<priority>][,<privacy>][,<cbn>][,<to>,<bn>][,<mtp>,<length>]
	<b><u>SMS STATUS REPORT</u></b>	
	<stat>,<ra>,<scts>,<mtp>,<mr>[,<ec>,<cc>]	<stat>,<ra>,<scts>,<mtp>,<mr>[,<ec>,<cc>][,<tor>,<a>]
<b>CMGL/MMGL</b>	<b><u>SMS-SUBMIT</u></b>	
	<index>,<stat>,<ts>,<da>]	<index>,<stat>,<ts>,<da>[,<toda>,<length>]
	<b><u>SMS-DELIVER</u></b>	
	<index>,<stat>,<ts>,<oa>	<index>,<stat>,<ts>,<oa>[,<scts>][,<tooa>,<length>]
	<b><u>Voice Mail Notification</u></b>	
	<index>,<stat>,<ts>,<oa>	<index>,<stat>,<ts>,<oa>[,<scts>][,<tooa>,<length>]
	<b><u>SMS STATUS REPORT</u></b>	
	<index>,<stat>,<ra>,<scts>,<mtp>,<mr>[,<ec>,<cc>]	<index>,<stat>,<ra>,<scts>,<mtp>,<mr>[,<ec>,<cc>][,<tor>,<a>]
<b>CMT report</b>	<ts>,<scts>,<oa>	<ts>,<scts>,<oa>[,<tooa>,<udh>,<lang>,<dc>,<priority>][,<privacy>][,<cbn>][,<to>,<bn>][,<rpl>][,<mtp>,<length>]
	<b><u>Voice Mail Notification</u></b>	
	<ts>,<scts>,<oa>	<ts>,<scts>,<oa>[,<tooa>,<udh>,<dc>,<priority>][,<privacy>][,<cbn>][,<mtp>,<length>]
<b>CDS report</b>	<ra>,<scts>,<mtp>,<mr>[,<ec>,<cc>]	<ra>,<scts>,<mtp>,<mr>[,<ec>,<cc>][,<tor>,<a>]

**Example**

```

AT+CSDH=?
+CSDH:(0,1)
OK
AT+CSDH?

```

```

+CSDH: 0
OK
AT+CMGR=160 // SMS-SUBMIT
+CMGR: "STO UNSENT","0544565034",
ABC
OK
AT+CSDH=1
OK
AT+CMGR=160
+CMGR: "STO UNSENT","0544565034",81,29,0,0,"04/11/04,09:48:36+08","+97254120032",145,3
ABC
OK

```

### +CSMP, Set Text Mode Parameters

This command is a basic command and is used to select values for additional parameters needed when SM is sent to the network or placed in storage when TEXT mode is selected.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CSMP=[,<tp>[,<vp>[,<lang>[,<dc>[,<rpl>]]]]]	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	The set command selects values for additional parameters needed when SM is sent to the network or placed in storage when text format message mode is selected.
<b>Read</b>	AT+CSMP?	<b>+CSMP:</b> <tp>,<vp>,<lang>,<dc>,<rpl> <b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	The read command returns the current parameters value.
<b>Test</b>	AT+ CSMP =?	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	The test command just returns OK.

The following table shows the +CSMP parameters.

**Table 3-32: +CSMP Parameters**

<Parameter>	Description																																							
<ttp>	Type of Validity Period. 0 - Do not need validity period (default). 1 - Validity Period in Relative format. 2 - Validity Period in Absolute format. Note: the default value should be set to 0.																																							
<vp>	Validity Period in Absolute format <table border="1"><thead><tr><th>Field</th><th>Length (bits)</th><th>Comments</th></tr></thead><tbody><tr><td>YEAR</td><td>8</td><td>Expiration year. This field shall be set to the expiration year, in the range 00-99.</td></tr><tr><td>MONTH</td><td>8</td><td>Expiration month. This field shall be set to the expiration month, in the range 1-12.</td></tr><tr><td>DAY</td><td>8</td><td>Expiration day of month. This field shall be set to the expiration day of the month.</td></tr><tr><td>HOURS</td><td>8</td><td>Expiration hour. This field shall be set to the expiration hour, in the range 0-23.</td></tr><tr><td>MINUTES</td><td>8</td><td>Expiration minutes. This field shall be set to the expiration minutes in the range 0-59.</td></tr><tr><td>SECONDS</td><td>8</td><td>Expiration seconds. This field shall be set to the expiration seconds, in the range 0-59.</td></tr></tbody></table> Validity Period in Relative format <table border="1"><thead><tr><th>Parameter</th><th>Description</th></tr></thead><tbody><tr><td>0 to 143</td><td>(value + 1) x 5 minutes.</td></tr><tr><td>144 to 167</td><td>12 hours + ((value - 143) x 30 minutes).</td></tr><tr><td>168 to 196</td><td>(value - 166) x 1 day.</td></tr><tr><td>197 to 255</td><td>(value - 192) x 1 week.</td></tr><tr><td>245</td><td>Indefinite.</td></tr><tr><td>246</td><td>Immediate.</td></tr><tr><td>247</td><td>Valid until mobile becomes inactive/ Deliver when mobile next becomes active.</td></tr><tr><td>249-255</td><td>Valid until registration area changes, discard if not registered.</td></tr></tbody></table>	Field	Length (bits)	Comments	YEAR	8	Expiration year. This field shall be set to the expiration year, in the range 00-99.	MONTH	8	Expiration month. This field shall be set to the expiration month, in the range 1-12.	DAY	8	Expiration day of month. This field shall be set to the expiration day of the month.	HOURS	8	Expiration hour. This field shall be set to the expiration hour, in the range 0-23.	MINUTES	8	Expiration minutes. This field shall be set to the expiration minutes in the range 0-59.	SECONDS	8	Expiration seconds. This field shall be set to the expiration seconds, in the range 0-59.	Parameter	Description	0 to 143	(value + 1) x 5 minutes.	144 to 167	12 hours + ((value - 143) x 30 minutes).	168 to 196	(value - 166) x 1 day.	197 to 255	(value - 192) x 1 week.	245	Indefinite.	246	Immediate.	247	Valid until mobile becomes inactive/ Deliver when mobile next becomes active.	249-255	Valid until registration area changes, discard if not registered.
Field	Length (bits)	Comments																																						
YEAR	8	Expiration year. This field shall be set to the expiration year, in the range 00-99.																																						
MONTH	8	Expiration month. This field shall be set to the expiration month, in the range 1-12.																																						
DAY	8	Expiration day of month. This field shall be set to the expiration day of the month.																																						
HOURS	8	Expiration hour. This field shall be set to the expiration hour, in the range 0-23.																																						
MINUTES	8	Expiration minutes. This field shall be set to the expiration minutes in the range 0-59.																																						
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Parameter	Description																																							
0 to 143	(value + 1) x 5 minutes.																																							
144 to 167	12 hours + ((value - 143) x 30 minutes).																																							
168 to 196	(value - 166) x 1 day.																																							
197 to 255	(value - 192) x 1 week.																																							
245	Indefinite.																																							
246	Immediate.																																							
247	Valid until mobile becomes inactive/ Deliver when mobile next becomes active.																																							
249-255	Valid until registration area changes, discard if not registered.																																							

**Table 3-32: +CSMP Parameters (Cont.)**

<Parameter>	Description
<lang>	<b>Language Indicator</b> The Language Indicator subparameter indicates the language of the message so that the receiving mobile station can discard those messages that are not in the user's preferred language.  <b>'0' - Unknown</b> <b>'1' - English (not supported)</b> <b>'2' - French (not supported)</b> <b>'3' - Spanish (not supported)</b> <b>'4' - Japanese (not supported)</b> <b>'5' - Korean (not supported)</b> <b>'6' - Chinese (not supported)</b> <b>'7' - Hebrew (not supported)</b>
<dc>	<b>Data Coding Scheme</b>  <b>'0' - Octet</b> <b>'1' - Extended Protocol Message (not supported)</b> <b>'2' - 7-bit ASCII - default</b> <b>'3' - IA5 (not supported)</b> <b>'4' - UNICODE</b> <b>'5' - Shift-JIS (not supported)</b> <b>'6' - Korean (not supported)</b> <b>'7' - Latin/Hebrew (not supported)</b> <b>'8' - Latin</b> <b>'9' - GSM 7-bit</b>
<rpl>	<b>Reply Option</b> The Reply Option subparameter indicates whether SMS acknowledgment is requested or not requested.  <b>0 - Report is not requested (default)</b> <b>1 - User Acknowledgment request</b> <b>2 - Delivery Acknowledgment request</b> <b>3 - Read Acknowledgment request</b> <b>4 - Delivery report request (not supported)</b>

## +CNMI, New Message Indications to Terminal

This command handles enabling of unsolicited notifications to the terminal when an SM is received by the C24.

After sending an unsolicited response to the TE, the C24 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 60 seconds. The C24 will not send another unsolicited response to the TE before the previous one is acknowledged. If acknowledged within the timeout, the new SM is not saved in the message storage. If not, the new SM is saved in the message storage and +CNMI parameters are set to 0.

If message storage is full and new SMS is received, the unsolicited response send to TE, the C24 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 1 second.

If acknowledged within the timeout, the new SM is deleted from the server. If not, the new SM is saved on the server and +CNMI parameters are set to 0.

**Note:** For Verizon network: In case "Message display mode" is ON, the new message indication will be display on the terminal no matter of the +CNMI command setting. In case no +CNMA command is set, the message will be stored automatically after 5 minutes.

Command Type	Syntax	Response/Action
<b>Set</b>	+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>
<b>Read</b>	+CNMI?	+CNMI:<mode>,<mt>,<bm>,<ds>,<bfr>
<b>Test</b>	+CNMI=?	+CNMI: (list of supported <mode>s), (list of supported <mt>s), (list of supported <bm>s), (list of supported <ds>s), (list of supported <bfr>s)

The following table shows the +CNMI parameters.

**Table 3-33: +CNMI Parameters**

<Parameter>	Description
<mode>	3 Forward unsolicited result codes directly to the terminal
<mt>	0 No SMS-DELIVER indications are routed to the terminal (default) 1 If SMS-DELIVER is stored in the C24, the memory location indication is routed to the terminal using the unsolicited result code: +CMTI: <mem>,<index> 2 SMS-DELIVER is routed directly to the terminal
<bm>	Will be supported in future release.
<ds>	0 No SMS-STATUS-REPORT indications are routed to the terminal (default) 1 SMS-STATUS-REPORT is routed directly to the terminal 2 If SMS-STATUS-REPORT is stored in the C24, the memory location indication is routed to the terminal using the unsolicited result code: +CDSI: <mem>,<index>
<bfr>	0 No SMS-STATUS reports are buffered.

### Example

```

AT+CNMI=?
+CNMI: (3),(0-2),(0,2),(0-2),(0)
OK
AT+CNMI?
+CNMI: 3,0,0,0
OK
AT+CNMI=3,1
OK
AT+CMSS=142,"0544565034" // send to myself

```

```
+CMSS: 72
OK
+CMTI: "SM",15
```

**+CMTI, Unsolicited Response (New SMS-DELIVER Receipt Indication)**

The +CMTI unsolicited response is sent to the TE upon receipt of a new SMS-DELIVER SM, if the +CNMI parameter <mt> is set to 1. Refer to “+CNMI, New Message Indications to Terminal” on page 3-62.

This unsolicited message indicates that a new SMS-DELIVER message was received, and is stored in location <index>:

```
+CMTI: <mem>,<index>
```

The following table shows the +CMTI parameters.

**Table 3-34: +CMTI Parameters**

<Parameter>	Description
<mem>	Message memory space. "RM" or "IM" memory storage.
<index>	Location of the new message.

**Example**

```
AT+CNMI=3,1
OK
AT+CMGS=25 //send to myself
03020000000A815020505227000000000000000020474657374
+CMTI: 69
OK
+CMTI: "RM",4
```

**+CMT, Unsolicited Response (New SMS-DELIVER Receipt)**

The +CMT unsolicited response is sent to the TE upon receipt of a new SMS-DELIVER SM if the +CNMI parameter <mt> is set to 2. Refer to “+CNMI, New Message Indications to Terminal” on page 3-62.

This unsolicited message displays the received SMS-DELIVER message:

In TEXT mode: (+CMGF=1):

```
+CMT: <ts>,<scts>,<oa>[,<tooa>,<udh>,<lang>,<dcs>[,<priority>],[<privacy>][,<cbn>][,<toctbn>][,<rpl>],
<length>]
<CR><LF><data>
```

In PDU mode: (+CMGF=0):

```
+CMT: <length><CR><LF><pdu>
```

**Note:** Show parameters according to +CSDH (see “+CSDH, Show Text Mode Parameters” on page 3-58).

The following table shows the +CMT parameters.

**Table 3-35: +CMT Parameters**

<Parameter>	Description
<oa>	Message origination address.
<scts>	Service center time stamp.
<tooa>	Type of origination address
<udh>	0 - SMS with out User Data Header 1 - SMS with User Data Header
<lang>	Language Indicator
<dc>	Data Coding Scheme
<priority>	Priority Indicator The Priority Indicator subparameter indicates the priority level of the message.  <u>Sprint:</u> 00 Normal (default) 01 Interactive 10 Urgent 11 Emergency  <u>Verizon:</u> 00 Normal (default) 01 High
<privacy>	Privacy Indicator The Privacy Indicator subparameter indicates the desired privacy level of the message.  00 Not restricted (privacy level 0) (default) 01 Restricted (privacy level 1) 10 Confidential (privacy level 2) 11 Secret (privacy level 3)
<cbn>	Call-Back Number The Call-Back Number subparameter indicates the number to be dialed in reply to a received SMS message.
<tocbn>	Type of Call back number
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: number of characters included in the <data>.
<data>	Message contents.
<pdu>	Message header and contents in PDU mode format.

**Table 3-35: +CMT Parameters (Cont.)**

<Parameter>	Description																											
<ts>	CDMA Teleservice <table><tr><th>&lt;ts&gt;</th><th>CDMA Teleservice</th><th>Network Teleservice</th></tr><tr><td>1</td><td>IS-91 Extended Protocol Enhanced Services</td><td>CMT-91</td></tr><tr><td>2</td><td>Wireless Paging Teleservice</td><td>CPT-95</td></tr><tr><td>3</td><td>Wireless Messaging Teleservice</td><td>CMT-95</td></tr><tr><td>4</td><td>Voice Mail Notification</td><td>VMN-95</td></tr><tr><td>5</td><td>Wireless Application Protocol</td><td>WAP</td></tr><tr><td>6</td><td>Wireless Enhanced Messaging Teleservice</td><td>WEMT</td></tr><tr><td>7</td><td>Service Category Programming Teleservice</td><td>SCPT</td></tr><tr><td>8</td><td>Card Application Toolkit Protocol Teleservice</td><td>CATPT</td></tr></table>	<ts>	CDMA Teleservice	Network Teleservice	1	IS-91 Extended Protocol Enhanced Services	CMT-91	2	Wireless Paging Teleservice	CPT-95	3	Wireless Messaging Teleservice	CMT-95	4	Voice Mail Notification	VMN-95	5	Wireless Application Protocol	WAP	6	Wireless Enhanced Messaging Teleservice	WEMT	7	Service Category Programming Teleservice	SCPT	8	Card Application Toolkit Protocol Teleservice	CATPT
<ts>	CDMA Teleservice	Network Teleservice																										
1	IS-91 Extended Protocol Enhanced Services	CMT-91																										
2	Wireless Paging Teleservice	CPT-95																										
3	Wireless Messaging Teleservice	CMT-95																										
4	Voice Mail Notification	VMN-95																										
5	Wireless Application Protocol	WAP																										
6	Wireless Enhanced Messaging Teleservice	WEMT																										
7	Service Category Programming Teleservice	SCPT																										
8	Card Application Toolkit Protocol Teleservice	CATPT																										
<nmes>	Number of (VM) Messages - part of the data in case of voice mail (see example in “+CMGL, +MMGL, List Messages” on page 3-68).																											

After sending a +CMT unsolicited response to the TE, the C24 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 60 seconds. The C24 will not send another +CMT and +CDS/CDSI unsolicited responses to the TE before the previous SMS was one is acknowledged. If the +CMT is acknowledged within the timeout, the new SM is not saved in the message storage. If the +CMT is not acknowledged and the timeout has expired, the new SM is saved in the message storage and +CNMI parameters <mt> and <ds> are set to 0.

### **+CNMA, New Message Acknowledgment**

This command acknowledges the receipt of a +CMT and +CDS response from the terminal to the C24. A +CMT response receipt confirms the correct reception of a new SMS-DELIVER message, which was routed directly to the terminal. A +CDS response receipt confirms the correct reception of a new SMS-STATUS-REPORT message, which was routed directly to the terminal.

When the C24 sends a +CDS response to the terminal, it waits a predefined timeout of 60 seconds for the +CNMA acknowledgment. The C24 will not send another +CDS result code to the terminal before the previous one is acknowledged, or the timeout expires.

When the C24 sends a +CMT response to the terminal, it waits a predefined timeout of 60 seconds for the +CNMA acknowledgment. The C24 will not send another +CMT result code to the terminal before the previous one is acknowledged, or the timeout expires.

Upon receipt of the +CNMA command, the C24 sends RP-ACK to the network. The acknowledged SM will not be saved in message storage.

If the C24 does not receive acknowledgment within the required time, it sends RP-ERROR to the network. The C24 automatically disables routing to the terminal by setting both <mt> and <ds> values of +CNMI to zero. The unacknowledged SM is saved in message storage.



If the command is executed but no acknowledgment is expected, or some other C24 related error occurs, the final result code +CMS ERROR: <err> is returned.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CNMA	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	
<b>Read</b>			The Read command for +CNMA is not defined by ETSI, and therefore is not supported by the C24. The C24 returns an error.
<b>Test</b>			The Test command for +CNMA is not defined by ETSI, and therefore is not supported by the C24. The C24 returns an error.

### +CDS, Unsolicited Response (New SMS-STATUS-REPORT Receipt)

The +CDS unsolicited response is sent to the TE upon receipt of a new mobile-terminated SM if the +CNMI parameter <ds> is set to '1'. For further information, refer to [“+CNMI, New Message Indications to Terminal” on page 3-62](#).

This unsolicited message displays the received SMS-DELIVER message.

#### Unsolicited Response

In text mode: (+CMGF=1):

**+CDS:** <ra>,<sets>,<mtp>,<mr>,[<ec>,<cc>],[<tor>]<CR><LF>

**Note:** For Show Text Mode Parameters see [Table 3-31](#).

In PDU mode: (+CMGF=0):

**+CDS:** <length><CR><LF><pdu>

The following table shows the +CDS parameters.

**Table 3-36: +CDS Parameters**

<Parameter>	Description
<mtp>	Message Type  '1' Deliver (mobile-terminated only not support in +CDS) '2' Submit (mobile-originated only not support in +CDS) '3' Cancellation (not supported) '4' Delivery Acknowledgment (mobile-terminated only) '5' User Acknowledgment '6' Read Acknowledgment '7' Deliver Report (not supported)
<mr>	Message Reference
<ra>	Message Recipient address

**Table 3-36: +CDS Parameters (Cont.)**

<b>&lt;Parameter&gt;</b>	<b>Description</b>
<b>&lt;tor&gt;</b>	Type of Recipient address
<b>&lt;scts&gt;</b>	Service center time stamp
<b>&lt;dt&gt;</b>	Discharge-Time
<b>&lt;ec&gt;</b>	Error class "0" - None (no error) "2" - Temporary "3" - Permanent
<b>&lt;cc&gt;</b>	Cause (status) code Error class="0" "0" - Message accepted "1" - Message deposit to Internet "2" -Message delivered "3" - Message cancelled  Error class="2" "4" - Network congestion "5" -Network error "31" -Unknown error  Error class="3" "4" - Network congestion "5" - Network error "6" - Cancel failed "7" - Blocked destination "8" - Text too long "9" - Duplicate message "10" -Invalid destination "11" -Message expired "31" Unknown error

After sending a +CDS unsolicited response to the TE, the C24 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 60 seconds. The C24 will not send another +CDS and +CMT/CMTI unsolicited responses to the TE before the previous SMS was one is acknowledged. If the +CDS is acknowledged within the timeout, the new SM is not saved in the message storage. If the +CDS is not acknowledged and the timeout has expired, the new SM is saved in the message storage and +CNMI parameters <ds> and <mt> are set to '0'.

### **+CMGL, +MMGL, List Messages**

These commands display a list of all SMs with the status value <stat>, from the C24 message storage <mem1> (selected using the +CPMS command). The command returns a series of responses, one per message, and each containing the message index, status, and data. If the status of a message is "RECEIVED UNREAD", execution of the +CMGL command changes the status of the message to "RECEIVED READ".

The +MMGL command does not change the message status. In addition, +MMGL includes a <stat> selection that can be used to query the C24 for a list of message headers without attendant message data.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CMGL [=<stat>] or +MMGL [=<stat>]	<p>If text mode (+CMGF=1) command execution is successful and <b>SMS-SUBMITs</b>:</p> <p>+CMGL:&lt;index&gt;,&lt;stat&gt;,&lt;ts&gt;,&lt;da&gt;,,[,&lt;toda&gt;,&lt;length&gt;]&lt;CR&gt;&lt;LF&gt;&lt;data&gt;[&lt;CR&gt;&lt;LF&gt;+CMGL:&lt;index&gt;,&lt;stat&gt;,&lt;ts&gt;,&lt;da&gt;,,[,&lt;toda&gt;,&lt;length&gt;]&lt;CR&gt;&lt;LF&gt;&lt;data&gt;[...]]</p> <p><b>SMS-DELIVERs</b></p> <p>+CMGL:&lt;index&gt;,&lt;stat&gt;,&lt;ts&gt;,&lt;oa&gt;,,[&lt;scs&gt;][,&lt;tooa&gt;,&lt;length&gt;]&lt;CR&gt;&lt;LF&gt;&lt;data&gt;[&lt;CR&gt;&lt;LF&gt;+CMGL:&lt;index&gt;,&lt;stat&gt;,&lt;ts&gt;,&lt;oa&gt;,,[&lt;scs&gt;][,&lt;tooa&gt;,&lt;length&gt;]&lt;CR&gt;&lt;LF&gt;&lt;data&gt;[...]]</p> <p><b>SMS STATUS REPORT</b></p> <p>+CMGL: &lt;index&gt;,&lt;stat&gt;,&lt;ra&gt;,&lt;scs&gt;,&lt;mtp&gt;,&lt;mr&gt;,[&lt;ec&gt;,&lt;c&gt;],[&lt;tora&gt;]</p> <p>or</p> <p>In PDU mode (+CMGF=0):</p> <p>+CMGL: &lt;index&gt;,&lt;stat&gt;,&lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;[&lt;CR&gt;&lt;LF&gt;+CMGL: &lt;index&gt;,&lt;stat&gt;,&lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;[...]]</p> <p><b>+CMS ERROR: &lt;err&gt;</b></p>	Show parameters according to +CSDH (see <a href="#">“+CSDH, Show Text Mode Parameters”</a> on page 3-58)
<b>Test</b>	+CMGL=? +MMGL=?	<p>+CMGL: (list of supported &lt;stat&gt;s)</p> <p>+MMGL: (list of supported &lt;stat&gt;s)</p>	The Test command lists all the supported <stats>

The following table shows the +CGML/+MMGL parameters.

**Table 3-37: +CGML/+MMGL Parameters**

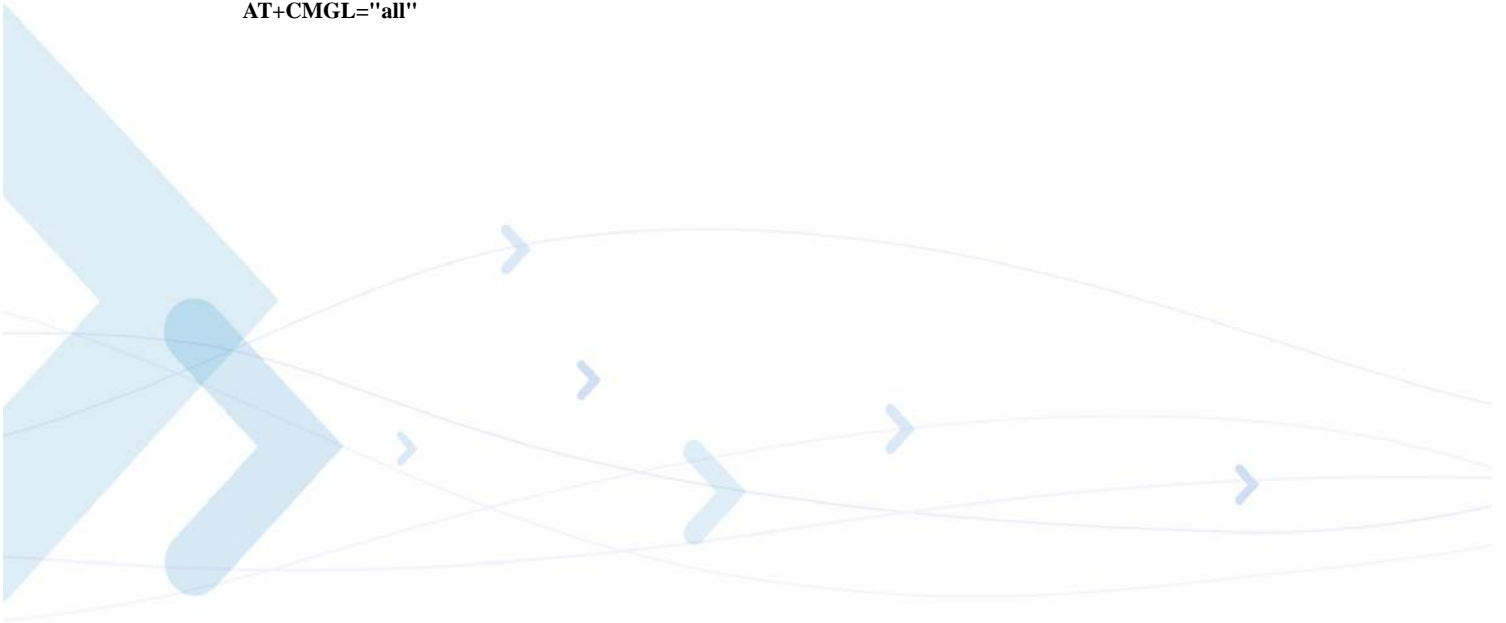
<Parameter>	Description																					
<index>	Index of message in storage.																					
<stat>	Status of message in memory: <table><tr><th>PDU mode</th><th>Text mode</th><th>Description</th></tr><tr><td>0</td><td>“REC UNREAD”</td><td>Received unread messages (default)</td></tr><tr><td>1</td><td>“REC READ”</td><td>Received read messages</td></tr><tr><td>2</td><td>“STO UNSENT”</td><td>Stored unsent messages</td></tr><tr><td>3</td><td>“STO SENT”</td><td>Stored sent message</td></tr><tr><td>4</td><td>“ALL”</td><td>All messages</td></tr><tr><td>5</td><td>“HEADER ONLY”</td><td>Header only (applies to +MMGL only)</td></tr></table>	PDU mode	Text mode	Description	0	“REC UNREAD”	Received unread messages (default)	1	“REC READ”	Received read messages	2	“STO UNSENT”	Stored unsent messages	3	“STO SENT”	Stored sent message	4	“ALL”	All messages	5	“HEADER ONLY”	Header only (applies to +MMGL only)
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5	“HEADER ONLY”	Header only (applies to +MMGL only)																				
<oa/da>	Original/destination address.																					
<data>	Message contents in text mode.																					
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: Number of characters included in <data>.																					
<pdu>	Message header and contents in PDU mode format.																					
<ct>	Command type.																					
<ra>	Recipient-Address																					
<ec>	Error class "0" - None (no error) "2" - Temporary "3" - Permanent																					

**Table 3-37: +CGML/+MMGL Parameters (Cont.)**

<Parameter>	Description																											
<cc>	<p>Cause (status) code Error class="0" "0" - Message accepted "1" - Message deposit to Internet "2" -Message delivered "3" - Message cancelled</p> <p>Error class="2" "4" - Network congestion "5" -Network error "31" -Unknown error</p> <p>Error class="3" "4" - Network congestion "5" - Network error "6" - Cancel failed "7" - Blocked destination "8" - Text too long "9" - Duplicate message "10" -Invalid destination "11" -Message expired "31" Unknown error</p>																											
<tora>	Type of Recipient-Address																											
<ts>	<p>CDMA Teleservice</p> <table><tr><th>&lt;ts&gt;</th><th>CDMA Teleservice</th><th>Network Teleservice</th></tr><tr><td>1</td><td>IS-91 Extended Protocol Enhanced Services</td><td>CMT-91</td></tr><tr><td>2</td><td>Wireless Paging Teleservice</td><td>CPT-95</td></tr><tr><td>3</td><td>Wireless Messaging Teleservice</td><td>CMT-95</td></tr><tr><td>4</td><td>Voice Mail Notification</td><td>VMN-95</td></tr><tr><td>5</td><td>Wireless Application Protocol</td><td>WAP</td></tr><tr><td>6</td><td>Wireless Enhanced Messaging Teleservice</td><td>WEMT</td></tr><tr><td>7</td><td>Service Category Programming Teleservice</td><td>SCPT</td></tr><tr><td>8</td><td>Card Application Toolkit Protocol Teleservice</td><td>CATPT</td></tr></table>	<ts>	CDMA Teleservice	Network Teleservice	1	IS-91 Extended Protocol Enhanced Services	CMT-91	2	Wireless Paging Teleservice	CPT-95	3	Wireless Messaging Teleservice	CMT-95	4	Voice Mail Notification	VMN-95	5	Wireless Application Protocol	WAP	6	Wireless Enhanced Messaging Teleservice	WEMT	7	Service Category Programming Teleservice	SCPT	8	Card Application Toolkit Protocol Teleservice	CATPT
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6	Wireless Enhanced Messaging Teleservice	WEMT																										
7	Service Category Programming Teleservice	SCPT																										
8	Card Application Toolkit Protocol Teleservice	CATPT																										
<nmes>	Number of (VM) Messages - Part of the data in case of voice mail (see example below).																											

**Example**

```
AT+CMGL=?  
+CMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL")  
OK  
AT+MMGL=?  
+MMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL","HEADER ONLY")  
OK  
AT+CMGL="ALL" //Read all SMS messages  
+CMGL: 1,"REC READ","0501234567",29  
This is a test "Hello world"  
+CMGL: 2,"STO UNSENT","0501234567",22  
this is a second test  
OK  
AT+CMGL="all"
```



## +CMGR, +MMGR, Read Message

These commands handle the reading of SMS. The command displays the message in location <index> of the preferred message storage <mem1> (selected using the +CPMS command). If the status of the message is "RECEIVED UNREAD", the +CMGR command changes the status to "RECEIVED READ". The +MMGR command does not change the message status.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CMGR=<index> or +MMGR=<index>	<p>If text mode (+CMGF=1) command execution is successful and <b>SMS-DELIVER</b>:</p> <p>+CMGR: &lt;stat&gt;,&lt;ts&gt;,&lt;scts&gt;,&lt;oa&gt;[,&lt;tooa&gt;,&lt;udh&gt;,&lt;lang&gt;,&lt;dcs&gt;[,&lt;priority&gt;][,&lt;privacy&gt;][,&lt;cbn&gt;][,&lt;to&gt;,&lt;cbn&gt;][,&lt;rpl&gt;],&lt;mtp&gt;,&lt;length&gt;] &lt;CR&gt;&lt;LF&gt;&lt;data&gt;</p> <p>If text mode (+CMGF=1) command execution is successful and <b>SMS-SUBMIT</b>:</p> <p>+CMGR: &lt;stat&gt;,&lt;ts&gt;,&lt;da&gt;[,&lt;toda&gt;,&lt;udh&gt;,&lt;lang&gt;,&lt;dcs&gt;,&lt;vtp&gt;,&lt;vp&gt;][,&lt;priority&gt;][,&lt;privacy&gt;][,&lt;cbn&gt;][,&lt;to&gt;,&lt;cbn&gt;][,&lt;rpl&gt;][,&lt;mtp&gt;][,&lt;length&gt;] &lt;CR&gt;&lt;LF&gt;&lt;data&gt;</p> <p><b><u>SMS-STATUS-REPORT</u></b></p> <p>+CMGR: &lt;stat&gt;,&lt;ra&gt;,&lt;scts&gt;,&lt;mtp&gt;,&lt;mr&gt;[,&lt;ec&gt;,&lt;cc&gt;][,&lt;tora&gt;]</p> <p>If PDU mode (+CMGF=0) and command execution is successful:</p> <p>+CMGR: &lt;stat&gt;,&lt;length&gt;&lt;CR&gt;&lt;LF&gt;&lt;pdu&gt;</p> <p>otherwise:</p> <p>+CMS ERROR: &lt;err&gt;</p>	<p>1. The Set command reads the SM located at &lt;index&gt; in the C24 message storage and displays it.</p> <p>2. Show parameters according to +CSDH (see “+CSDH, Show Text Mode Parameters” on page 3-58).</p>

The following table shows the +CMGR parameters.

**Table 3-38: +CMGR/+MMGR Parameters**

<Parameter>	Description																		
<index>	<div>1-352 Index in storage of the message. to be retrieved.</div> <table><tr><th>&lt;mem1&gt;</th><th>Valid Indexes</th><th>Location of Message Storage</th></tr><tr><td>"IM"/"RM"</td><td>1-100</td><td>Actually there are indexes according to the R-UIM (if present) capacity. A new message is stored in the first free location, starting from 1.</td></tr><tr><td>"ME"</td><td rowspan="3">101-352</td><td rowspan="3">All storages, associated with ME, shared the same range. A new message is stored in the first free location, starting from the last index that has been used.</td></tr><tr><td>"MT"</td></tr><tr><td>"BM"</td></tr></table>	<mem1>	Valid Indexes	Location of Message Storage	"IM"/"RM"	1-100	Actually there are indexes according to the R-UIM (if present) capacity. A new message is stored in the first free location, starting from 1.	"ME"	101-352	All storages, associated with ME, shared the same range. A new message is stored in the first free location, starting from the last index that has been used.	"MT"	"BM"							
<mem1>	Valid Indexes	Location of Message Storage																	
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"MT"																			
"BM"																			
<stat>	<div>Status of message in memory:</div> <table><tr><th>PDU mode</th><th>Text mode</th><th>Description</th></tr><tr><td>0</td><td>“REC UNREAD”</td><td>Received unread messages (default)</td></tr><tr><td>1</td><td>“REC READ”</td><td>Received read messages</td></tr><tr><td>2</td><td>“STO UNSENT”</td><td>Stored unsent messages</td></tr><tr><td>3</td><td>“STO SENT”</td><td>Stored sent message</td></tr><tr><td>4</td><td>“ALL”</td><td>All messages</td></tr></table> <div><b>Note:</b> 1. status "4" ="ALL" is relevant for +CMGL/+MMGL commands. 2. "default" is relevant for +CMGL/+MMGL commands.</div>	PDU mode	Text mode	Description	0	“REC UNREAD”	Received unread messages (default)	1	“REC READ”	Received read messages	2	“STO UNSENT”	Stored unsent messages	3	“STO SENT”	Stored sent message	4	“ALL”	All messages
PDU mode	Text mode	Description																	
0	“REC UNREAD”	Received unread messages (default)																	
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2	“STO UNSENT”	Stored unsent messages																	
3	“STO SENT”	Stored sent message																	
4	“ALL”	All messages																	
<oa/da>	Message origination/destination address.																		
<scts>	Service center time stamp.																		
<tooa/toda>	Type of origination/destination address.																		
<mtp>	<div>Message Type</div> <div>'1' Deliver (mobile-terminated only not support in +CDS) '2' Submit (mobile-originated only not support in +CDS)) '3' Cancellation (not supported) '4' Delivery Acknowledgment (mobile-terminated only) '5' User Acknowledgment '6' Read Acknowledgment '7' Deliver Report (not supported)</div>																		
<lang>	Language Indicator																		
<dcs>	Data Coding Scheme																		



**Table 3-38: +CMGR/+MMGR Parameters (Cont.)**

<Parameter>	Description
<priority>	<b>Priority Indicator</b> The Priority Indicator subparameter indicates the priority level of the message.  <u>Sprint:</u> 00 Normal (default) 01 Interactive 10 Urgent 11 Emergency  <u>Verizon:</u> 00 Normal (default) 01 High
<privacy>	<b>Privacy Indicator</b> The Privacy Indicator subparameter indicates the desired privacy level of the message.  00 Not restricted (privacy level 0) (default) 01 Restricted (privacy level 1) 10 Confidential (privacy level 2) 11 Secret (privacy level 3)
<cbn>	<b>Call-Back Number</b> The Call-Back Number subparameter indicates the number to be dialed in reply to a received SMS message.
<tocbn>	Type of Call Back Number.
<rpl>	<b>Reply Option</b> The Reply Option subparameter indicates whether SMS acknowledgment is requested or not requested.
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: number of characters included in the <data>.
<data>	Message contents.
<vp>	Validity Period in Absolute or Relative format According to +CSMP setting.
<dt>	Discharge Time.
<ec>	<b>Error class</b> "0" - None (no error) "2" - Temporary "3" - Permanent

**Table 3-38: +CMGR/+MMGR Parameters (Cont.)**

<Parameter>	Description																											
<cc>	<p><b>Cause (status) code</b></p> <p>Error class="0"</p> <p>"0" - Message accepted</p> <p>"1" - Message deposit to Internet</p> <p>"2" -Message delivered</p> <p>"3" - Message cancelled</p> <p>Error class="2"</p> <p>"4" - Network congestion</p> <p>"5" -Network error</p> <p>"31" -Unknown error</p> <p>Error class="3"</p> <p>"4" - Network congestion</p> <p>"5" - Network error</p> <p>"6" - Cancel failed</p> <p>"7" - Blocked destination</p> <p>"8" - Text too long</p> <p>"9" - Duplicate message</p> <p>"10" -Invalid destination</p> <p>"11" -Message expired</p> <p>"31" Unknown error</p>																											
<ra>	Recipient Address.																											
<sn>	Message serial number.																											
<ts>	<p>CDMA Teleservice</p> <table><tr><th>&lt;ts&gt;</th><th>CDMA Teleservice</th><th>Network Teleservice</th></tr><tr><td>1</td><td>IS-91 Extended Protocol Enhanced Services</td><td>CMT-91</td></tr><tr><td>2</td><td>Wireless Paging Teleservice</td><td>CPT-95</td></tr><tr><td>3</td><td>Wireless Messaging Teleservice</td><td>CMT-95</td></tr><tr><td>4</td><td>Voice Mail Notification</td><td>VMN-95</td></tr><tr><td>5</td><td>Wireless Application Protocol</td><td>WAP</td></tr><tr><td>6</td><td>Wireless Enhanced Messaging Teleservice</td><td>WEMT</td></tr><tr><td>7</td><td>Service Category Programming Teleservice</td><td>SCPT</td></tr><tr><td>8</td><td>Card Application Toolkit Protocol Teleservice</td><td>CATPT</td></tr></table>	<ts>	CDMA Teleservice	Network Teleservice	1	IS-91 Extended Protocol Enhanced Services	CMT-91	2	Wireless Paging Teleservice	CPT-95	3	Wireless Messaging Teleservice	CMT-95	4	Voice Mail Notification	VMN-95	5	Wireless Application Protocol	WAP	6	Wireless Enhanced Messaging Teleservice	WEMT	7	Service Category Programming Teleservice	SCPT	8	Card Application Toolkit Protocol Teleservice	CATPT
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7	Service Category Programming Teleservice	SCPT																										
8	Card Application Toolkit Protocol Teleservice	CATPT																										
<pdu>	Message header and contents in PDU mode format.																											
<nmes>	Number of (VM) Messages - part of the data in case of voice mail (see example in “+CMGL, +MMGL, List Messages” on page 3-68).																											

**Example**

AT+CMGR=253

```
+CMGR: "REC UNREAD",4,"08/09/28,11:19:04","502",129,0,2,0,0,"*151",129,1,30
```

```
Last msg from 0545817771. 3 Voice. // the user data received from the network
```

```
OK // 3=<nmes>
```

## +MMAR, Motorola Mark As Read

This command handles changing the <stat> attribute of an SM in the C24 memory location <index>, preferred message storage <mem1>, from "REC UNREAD" to "REC READ". (<mem1> is selected using the +CPMS command.) If the status change fails, +CMS ERROR: <err> is returned.

Command Type	Syntax	Response/Action	Remarks
Set	+MMAR=<index>	OK or: +CMS ERROR: <err>	

The following table shows the +MMAR parameters.

**Table 3-39: +MMAR Parameters**

<Parameter>	Description
<index>	Index of the message to be marked as read, in the SMS memory.

### Example

```
AT+MMGR=1
+MMGR: "REC UNREAD","+972544565034",,"04/11/04,09:48:36+08"
message text
OK
AT+MMAR=1
OK
AT+MMGR=1
+MMGR: "REC READ","+972544565034",,"04/11/04,09:48:36+08"
message text
OK
```

## +CMGW, Write Message to Memory

This command is used to write and save a message to <mem2>. The message is saved in memory, and the message index is displayed to the user.

By default, messages are saved with the status of "STO UNSENT", but status "STO SENT" can be applied using the <stat> parameter.

In TEXT mode, the header parameters will be set according to +CSMP settings.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<p>If text mode (+CMGF=1):  <b>+CMGW=[&lt;da&gt;],[&lt;ts&gt;],[&lt;udh&gt;],[&lt;toda&gt;],[&lt;priority&gt;],[&lt;privacy&gt;],[&lt;cbn&gt;],[&lt;tochn&gt;]]</b>  <b>&lt;CR&gt;&lt;LF&gt;&lt;data&gt;</b>  <b>text is entered&lt;ctrl-Z/ESC&gt;</b></p> <p>If PDU mode (+CMGF=0):  <b>+CMGW=&lt;length&gt;[,&lt;stat&gt;]&lt;CR&gt;</b> PDU is given&lt;ctrl-Z/ESC&gt;</p>	<b>+CMGW: &lt;index&gt;</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	The Set command writes a message and stores it.

The following table shows the +CMGW parameters.

**Table 3-40: +CMGW Parameters**

<Parameter>	Description
<b>&lt;da&gt;</b>	Destination address in quoted string. This field contains a single phone number.
<b>&lt;toda&gt;</b>	Type of DA. Value between 128-255 (according to GSM 03.40, 9.1.2.5). If this field is not given and first character of <da> is '+', <toda> will be 145, otherwise 129.
<b>&lt;stat&gt;</b>	Status of new message In text mode: "STO UNSENT" (default) or "STO SENT" In PDU mode: 2 (default) or 3
<b>&lt;length&gt;</b>	Size of message in PDU mode format, in octets, excluding SMSC data.
<b>&lt;index&gt;</b>	Index in storage of the stored message.
<b>&lt;PDU&gt;</b>	Message header and contents in PDU mode format.
<b>&lt;priority&gt;</b>	<p><b>Priority Indicator</b>  The Priority Indicator subparameter indicates the priority level of the message.</p> <p><u>Sprint:</u>  00 Normal (default)  01 Interactive  10 Urgent  11 Emergency</p> <p><u>Verizon:</u>  00 Normal (default)  01 High</p>

**Table 3-40: +CMGW Parameters (Cont.)**

<Parameter>	Description																											
<privacy>	<b>Privacy Indicator</b> The Privacy Indicator subparameter indicates the desired privacy level of the message.  00 Not restricted (privacy level 0) (default) 01 Restricted (privacy level 1) 10 Confidential (privacy level 2) 11 Secret (privacy level 3)																											
<cbn>	<b>Call-Back Number</b> The Call-Back Number subparameter indicates the number to be dialed in reply to a received SMS message.																											
<tocbn>	Type of Call Back Number.																											
<udh>	0 - SMS with out User Data Header (default) 1 - SMS with User Data Header																											
<ts>	CDMA Teleservice <table><tr><th>&lt;ts&gt;</th><th>CDMA Teleservice</th><th>Network Teleservice</th></tr><tr><td>1</td><td>IS-91 Extended Protocol Enhanced Services</td><td>CMT-91</td></tr><tr><td>2</td><td>Wireless Paging Teleservice</td><td>CPT-95</td></tr><tr><td>3</td><td>Wireless Messaging Teleservice</td><td>CMT-95</td></tr><tr><td>4</td><td>Voice Mail Notification</td><td>VMN-95</td></tr><tr><td>5</td><td>Wireless Application Protocol</td><td>WAP</td></tr><tr><td>6</td><td>Wireless Enhanced Messaging Teleservice</td><td>WEMT</td></tr><tr><td>7</td><td>Service Category Programming Teleservice</td><td>SCPT</td></tr><tr><td>8</td><td>Card Application Toolkit Protocol Teleservice</td><td>CATPT</td></tr></table>	<ts>	CDMA Teleservice	Network Teleservice	1	IS-91 Extended Protocol Enhanced Services	CMT-91	2	Wireless Paging Teleservice	CPT-95	3	Wireless Messaging Teleservice	CMT-95	4	Voice Mail Notification	VMN-95	5	Wireless Application Protocol	WAP	6	Wireless Enhanced Messaging Teleservice	WEMT	7	Service Category Programming Teleservice	SCPT	8	Card Application Toolkit Protocol Teleservice	CATPT
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7	Service Category Programming Teleservice	SCPT																										
8	Card Application Toolkit Protocol Teleservice	CATPT																										

### +CMSS, Send Message From Storage

This command sends a pre-stored message, written previously using the +CMGW command. The <da>, <tda>, <priority>, <privacy>, <cbn> parameters are optional. If these parameters are given, the message is sent accordingly. Otherwise the message is sent according to +CMGW setting. If no DA is found, an error occurs.

When the given index is an incoming message index the header settings will be as follows:

- SMS will be SMS-SUBMIT and <typ> - relative.
- The <rpl> and <udh> settings will be taken from the incoming message.
- <vp> - will be set to the default value -167 - as defined in 03.40.
- <ts>, <scts>, <tosca>, <lang> and <dcs> will be set according the incoming message parameters.

- If <da> and/or <toa> are not given by the command, the <oa> and <toa> will be set instead.
- If <priority>, <privacy> and <cbn> are not given by the command, it will be taken from the incoming message.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CMSS=<index>[,<da>[,<toa>][,<priority>][,<privacy>][,<cbn>]]	+CMSS: <mr> or: +CMS ERROR: <err>	The Set command sends a message from storage to the network.

The following table shows the +CMSS parameters.

**Table 3-41: +CMSS Parameters**

<Parameter>	Description
<index>	Index in storage of the message to be sent.
<da>	Destination address in quoted string. This field contains a single phone number.
<toa>	Type of DA. Value between 128-255. If this field is not given and first character of <da> is '+', <toa> will be 145, otherwise 129.
<mr>	Sent message reference number.
<priority>	<b>Priority Indicator</b> The Priority Indicator subparameter indicates the priority level of the message.  <u>Sprint:</u> 00 Normal (default) 01 Interactive 10 Urgent 11 Emergency  <u>Verizon:</u> 00 Normal (default) 01 High
<privacy>	<b>Privacy Indicator</b> The Privacy Indicator subparameter indicates the desired privacy level of the message.  00 Not restricted (privacy level 0) (default) 01 Restricted (privacy level 1) 10 Confidential (privacy level 2) 11 Secret (privacy level 3)
<cbn>	<b>Call-Back Number</b> The Call-Back Number subparameter indicates the number to be dialed in reply to a received SMS message.

**Example**

```

AT+CMSS=7
+CMSS: 12
OK
AT+CMSS=7,"054565132",129
+CMSS: 13
OK

```

**Note:** Any character sent by TE to C24 before C24 has reported a result of AT+CMSS operation, will abort AT+CMSS command execution. However, if SMS was already sent to network and sending operation was successful, the result of operation "+CMSS <mr>" will be reported by C24. If after aborting AT+CMSS command execution and before result of operation was reported by C24, a second AT+CMSS command is executed, then the result of the second AT+CMSS operation only will be reported by C24.

**+CMGD, Delete Message**

This command handles deletion of a single message from memory location <index>, or multiple messages according to <delflag>. If the optional parameter <delflag> is entered, and is greater than 0, the <index> parameter is practically ignored. If deletion fails, result code +CMS ERROR: <err> is returned.

**Note:** The deletion of multiple commands is a time-consuming process that may require more than 60 seconds to complete.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CMGD=<index> [,<delflag>]	<b>OK</b> or: +CMS ERROR: <err>	
<b>Read</b>			The Read command for +CMGD is not defined by ETSI, and therefore is not supported by the C24. The C24 returns an error.
<b>Test</b>	+CMGD=?	+CMGD: (list of valid <index>s), (list of valid <delflag>s)	The Test command displays the supported values of <n>.

The following table shows the +CMGD parameters.

**Table 3-42: +CMGD Parameters**

<Parameter>	Description
<index>	1-352 Index in the SMS memory of the message to be deleted.
<delflag>	0 Deletes the message specified in <index> 1 Deletes all read messages 2 Deletes all read messages and sent MO messages 3 Deletes all read messages, sent and unsent MO messages 4 Deletes all messages

**Example**

```

AT+CMGD=4
OK
AT+CMGD=1,3
OK

```

**+CMGS, Send SM to Network**

This command sends an SM from the C24 to the network. The message reference value <mr> is returned to the C24 upon successful delivery of the message.

**Note:** The DCD signal shall be in ON state while text is entered.

The header parameters in TEXT mode will be set according to CSMP settings.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	If text mode (+CMGF=1): <b>+CMGS=&lt;da&gt;,&lt;ts&gt;,&lt;udh&gt;[,&lt;toda&gt;][,&lt;priority&gt;][,&lt;privacy&gt;][,&lt;cbn&gt;]</b> <b>&lt;CR&gt;&lt;LF&gt;&lt;data&gt;</b> <b>&lt;CR&gt;</b> text is entered<ctrl-Z/ESC> If PDU mode (+CMGF=0): <b>+CMGS=&lt;length&gt;&lt;CR&gt;</b> <b>PDU is entered&lt;ctrl-Z/ESC&gt;</b>	<b>+CMGS: &lt;mr&gt;</b> <b>+CMS ERROR: &lt;err&gt;</b>	The Set command validates the input parameters, sends the SM to network and reports the result of the operation to the C24.

The following table shows the +CMGS parameters.

**Table 3-43: +CMGS Parameters**

<Parameter>	Description
<b>&lt;da&gt;</b>	Destination address in quoted string. This field contains a single MIN number.
<b>&lt;toda&gt;</b>	Type of DA. Value between 128-255. If this field is not given and first character of <da> is '+', <toda> will be 145, otherwise 129.
<b>&lt;length&gt;</b>	Size of message in PDU mode format, in octets, excluding SMSC data.
<b>&lt;mr&gt;</b>	Sent message reference number.
<b>&lt;udh&gt;</b>	0 - SMS with out User Data Header 1 - SMS with User Data Header
<b>PDU</b>	Message header and contents in PDU mode format.



**Table 3-43: +CMGS Parameters (Cont.)**

<Parameter>	Description																											
<priority>	<p><b>Priority Indicator</b></p> <p>The Priority Indicator subparameter indicates the priority level of the message.</p> <p><u>Sprint:</u></p> <p>00 Normal (default)</p> <p>01 Interactive</p> <p>10 Urgent</p> <p>11 Emergency</p> <p><u>Verizon:</u></p> <p>00 Normal (default)</p> <p>01 High</p>																											
<privacy>	<p><b>Privacy Indicator</b></p> <p>The Privacy Indicator subparameter indicates the desired privacy level of the message.</p> <p>00 Not restricted (privacy level 0) (default)</p> <p>01 Restricted (privacy level 1)</p> <p>10 Confidential (privacy level 2)</p> <p>11 Secret (privacy level 3)</p>																											
<cbn>	<p><b>Call-Back Number</b></p> <p>The Call-Back Number subparameter indicates the number to be dialed in reply to a received SMS message.</p>																											
<ts>	<p>CDMA Teleservice</p> <table><tr><th>&lt;ts&gt;</th><th>CDMA Teleservice</th><th>Network Teleservice</th></tr><tr><td>1</td><td>IS-91 Extended Protocol Enhanced Services</td><td>CMT-91</td></tr><tr><td>2</td><td>Wireless Paging Teleservice</td><td>CPT-95</td></tr><tr><td>3</td><td>Wireless Messaging Teleservice</td><td>CMT-95</td></tr><tr><td>4</td><td>Voice Mail Notification</td><td>VMN-95</td></tr><tr><td>5</td><td>Wireless Application Protocol</td><td>WAP</td></tr><tr><td>6</td><td>Wireless Enhanced Messaging Teleservice</td><td>WEMT</td></tr><tr><td>7</td><td>Service Category Programming Teleservice</td><td>SCPT</td></tr><tr><td>8</td><td>Card Application Toolkit Protocol Teleservice</td><td>CATPT</td></tr></table>	<ts>	CDMA Teleservice	Network Teleservice	1	IS-91 Extended Protocol Enhanced Services	CMT-91	2	Wireless Paging Teleservice	CPT-95	3	Wireless Messaging Teleservice	CMT-95	4	Voice Mail Notification	VMN-95	5	Wireless Application Protocol	WAP	6	Wireless Enhanced Messaging Teleservice	WEMT	7	Service Category Programming Teleservice	SCPT	8	Card Application Toolkit Protocol Teleservice	CATPT
<ts>	CDMA Teleservice	Network Teleservice																										
1	IS-91 Extended Protocol Enhanced Services	CMT-91																										
2	Wireless Paging Teleservice	CPT-95																										
3	Wireless Messaging Teleservice	CMT-95																										
4	Voice Mail Notification	VMN-95																										
5	Wireless Application Protocol	WAP																										
6	Wireless Enhanced Messaging Teleservice	WEMT																										
7	Service Category Programming Teleservice	SCPT																										
8	Card Application Toolkit Protocol Teleservice	CATPT																										

**Example**

AT+CMGS="064593042",129

>This is the message body <CTRL+Z> //<CTRL+Z> ends the prompt text mode and returns to regular AT command mode

OK

**Note:** Any character sent by TE to C24 before C24 has reported a result of AT+CMGS operation, will abort AT+CMGS command execution. However, if SMS was already sent to network and sending operation was successful, the result of operation "+CMGS <mr>" will be reported by C24.

A flex dependant enhancement enables the reporting of numeric error code to TE, in case the sending operation has failed. The numeric error code will be reported in format: "+CMS ERROR: <err>".

If after aborting AT+CMGS command execution and before result of operation was reported by C24, a second AT+CMGS command is executed, then the result of the second AT+CMGS operation only will be reported by C24.

## Layout of SMS in PDU Mode

The following tables show the layout of SMS in PDU mode.

**Table 3-44: Layout of SMS-SUBMIT in PDU Mode**

Reference	Description	Length
<ts>	CDMA Teleservice	1 byte
<mtp>	Message type	1 byte
<mr>	Sent message reference number	2 bytes
<udh>	User Data Header	1 byte
<dalen>	Message Destination Address length	1 byte
<toda>	Type of destination address	1 byte
<da>	Message Destination address	0-16 bytes
<tv>	Type of Validity Period	1 byte
<vp>	Validity Period	0,1,6 bytes
<priority>	Priority Indicator	1 byte
<privacy>	Privacy Indicator	1 byte
<rpl>	Reply Option	1 byte
<lang>	Language Indicator	1 byte
<cbnlen>	Call-Back Number length	1 byte
<tocbn>	Type of Call-Back Number	1 byte
<cbn>	Call-Back Number	0-16 bytes
<dcs>	Data Coding Scheme	1 byte
<udl>	User Data Length	1 byte
<ud>	User Data	0-140 bytes

**Table 3-45: Layout of SMS-DELIVER in PDU Mode**

Reference	Description	Length
<ts>	CDMA Teleservice	1 byte
<mtp>	Message type	1 byte
<udh>	User Data Header	1 byte
<oalen>	Message Origination Address length	1 byte
<tooa>	Type of origination address	1 byte
<oa>	Origination address	0-16 bytes
<scts>	Service center time stamp	6 bytes
<priority>	Priority Indicator	1 byte
<privacy>	Privacy Indicator	1 byte
<rpl>	Reply Option	1 byte
<lang>	Language Indicator	1 byte
<cbnlen>	Call-Back Number length	1 byte
<tocbn>	Type of Call-Back Number	1 byte
<cbn>	Call-Back Number	0-16 bytes
<dcs>	Data Coding Scheme	1 byte
<udl>	User Data Length	1 byte
<ud>	User Data	0-140 bytes

**Table 3-46: Layout of SMS-STATUS-REPORT in PDU Mode**

Reference	Description	Length
<ts>	CDMA Teleservice	1 byte
<mtp>	Message type	1 byte
<mr>	Message Reference number	2 bytes
<ralen>	Message Recipient Address length	1 byte
<tora>	Type of recipient address	1 byte
<ra>	Recipient address	0-16 bytes
<scts>	Service center time stamp	6 bytes
<ec>	Error Class	1 byte
<cc>	Cause Code	1 byte

**Table 3-47: Layout of WAP PUSH in PDU Mode**

Reference	Description	Length
<ts>	CDMA Teleservice	1 byte
<mtp>	Message type	1 byte
<mr>	Message Reference	2 bytes
<udh>	User Data Header	1 byte
<oalen>	Message Origination Address length	1 byte
<tooa>	Type of origination address	1 byte
<oa>	Origination address	0-16 bytes
<scts>	Service center time stamp	6 bytes
<udl>	User Data Length	1 byte
<ud>	User Data	0-140 bytes

**Table 3-48: Layout of Broadcast Message in PDU Mode**

Reference	Description	Length
<ts>	CDMA Teleservice	1 byte
<mtp>	Message type	1 byte
<mr>	Message Reference	2 bytes
<Service Category>	Service Category	2 bytes
<udl>	User Data Length	1 byte
<ud>	User Data	0-140 bytes

**Table 3-49: Layout of Voice Mail Notification in PDU Mode**

Reference	Description	Length
<ts>	CDMA Teleservice	1 byte
<mtp>	Message type	1 byte
<udh>	User Data Header	1 byte
<oalen>	Message Origination Address length	1 byte

**Table 3-49: Layout of Voice Mail Notification in PDU Mode (Cont.)**

Reference	Description	Length
<tooa>	Type of origination address	1 byte
<oa>	Origination address	0-16 bytes
<scts>	Service center time stamp	6 bytes
<priority>	Priority Indicator	1 byte
<privacy>	Privacy Indicator	1 byte
<nmes>	Number of Messages	2 bytes
<cbnlen>	Call-Back Number length	1 byte
<tocbn>	Type of Call-Back Number	1 byte
<cbn>	Call-Back Number	0-16 bytes
<dcs>	Data Coding Scheme	1 byte
<udl>	User Data Length	1 byte
<ud>	User Data	0-140 bytes

## Network

### Network Service Commands

#### +CREG, Network Registration Status

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CREG=<n>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command controls the presentation of an unsolicited result code and the result of the Read operation.
<b>Read</b>	AT+CREG?	<b>+CREG:</b> <b>&lt;n&gt;&lt;SID&gt;,&lt;NID&gt;,&lt;stat&gt;</b> <b>&gt;</b> <b>OK</b>	The Read command returns the status of the result code presentation and shows whether the network has currently indicated the registration of the C24.
<b>Test</b>	AT+CREG=?	<b>+CREG: (list of supported &lt;n&gt;s)</b> <b>OK</b>	

The following table shows the +CREG parameters.

**Table 3-50: +CREG Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	0 Disables the network registration unsolicited result code. 1 Enables the network registration unsolicited result code +CREG: <SID>,<NID>,<stat>.
<b>&lt;SID&gt;</b>	0-32767 System ID.
<b>&lt;NID&gt;</b>	0-65535 Network ID.
<b>&lt;stat&gt;</b>	0 Not registered. 1 Registered, home network. 2 Not registered, but the ME is currently searching for a new operator to which to register. 3 Registration denied. 5 Registered, roaming.

**Example**

```

AT+CREG=?
+CREG: (0-1)
OK
AT+CREG?
+CREG: 8465,65535,1
OK
AT+CREG=1
OK
+CREG: 8465,65535,1

```

**+CSQ, Signal Strength**

This command returns the Signal Quality Measure <SQM> and the Frame Error Rate <FER> from the C24.

Command Type	Syntax	Response/Action
Execute/Read	AT+CSQ	+CSQ: <SQM>, <FER>
	AT+CSQ?	OK
Test	AT+CSQ=?	+CSQ: (list of supported <SQM>s),(list of supported <FER>s) OK

The following table shows the +CSQ parameters.

**Table 3-51: +CSQ Parameters**

<Parameter>	Description
<SQM>	0 through 31 - covers the range of -113 dbm (or less) to -51dbm (or greater) 99 - <SQM> is Unknown or not detectable
<FER>	0 0.01% 1 0.01% to less than 0.1% 2 0.1% to less than 0.5% 3 0.5% to less than 1.0% 4 1.0% to less than 2.0% 5 2.0% to less than 4.0% 6 4.0% to less than 8.0% 7 =8.0% 99 <FER> is not known or is not detectable

**Example**

```

AT+CSQ
+CSQ: 31,0
OK
AT+CSQ=?
+CSQ: (0-31,99),(0-7,99)
OK

```

## +MSSI, Request Signal Strength Messages

This command enables/disables the unsolicited report for signal strength value. When unsolicited reporting is enabled, and a change occurs in the signal strength a report will be sent to TE.

It can also request the current signal strength by using the query form of this command.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MSSI=<n>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command controls the presentation of an unsolicited result code.
<b>Read</b>	AT+MSSI?	<b>+MSSI: &lt;signal strength&gt;</b>	The Read command returns the status of the result code presentation and shows The current signal strength represented as a percentage value.
<b>Test</b>	AT+MSSI=?	<b>+MSSI: (list of supported &lt;n&gt;s)</b> <b>OK</b>	

The following table shows the +MSSI parameters.

**Table 3-52: +MSSI Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	Signal Strength Message Enable Settings 0 Signal Strength Messages Off 1 Signal Strength Messages On
<b>&lt;signal strength&gt;</b>	The current signal strength represented as a percentage value 0% through 100% - covers the range of -113 dbm (or less) to -51dbm (or greater)

### Example

```
AT+MSSI?
+MSSI: 69           // 69% Signal Strength
AT+MSSI=1
OK
+MSSI: 69
```



## Network Parameters Commands

### +NETPAR, List Cellular Network Parameters

This command displays information regarding the active, candidate, and neighbor cell.

Command Type	Syntax	Response/Action
Set	AT+NETPAR =<mode>	<p><b><u>In case mode =0</u></b>  + NETPAR: &lt;channel&gt;,&lt;PN&gt;,&lt;SID&gt;,&lt;NID&gt;,&lt;slot cycle index&gt;,&lt;rssi&gt;,&lt;Ec/Io&gt;,&lt;Tx power&gt;,&lt;Tx Adj&gt;  OK</p> <p><b><u>In case mode =1</u></b>  + NETPAR: &lt; candidate PN&gt;,&lt; Candidate Ec/Io&gt;  OK</p> <p><b><u>In case mode =2</u></b>  + NETPAR: &lt;channel&gt;,&lt;PN&gt;,&lt;SID&gt;,&lt;NID&gt;,&lt;slot cycle index&gt;,&lt;rssi&gt;,&lt;Ec/Io&gt;,&lt;Tx power&gt;,&lt;Tx Adj&gt;&lt;CR&gt;&lt;LF&gt;  [&lt; neighbor 1 PN&gt;,&lt; neighbor 1 Ec/Io&gt;&lt;CR&gt;&lt;LF&gt;  [&lt; neighbor 2 PN&gt;,&lt; neighbor 2 Ec/Io&gt;&lt;CR&gt;&lt;LF&gt;  .....  &lt; neighbor 6 PN&gt;,&lt; neighbor 6 Ec/Io&gt;]  OK</p> <p>or:</p> <p>+CME ERROR: &lt;err&gt;</p>
Test	AT+NETPAR=?	+ NETPAR: < List of supported modes>

The following table shows the +NETPAR parameters.

**Table 3-53: +NETPAR Parameters**

<Parameter>	Description
<mode>	0 - Active cell 1 - Candidate cell 2 - Neighbor cell
<Channel>	An ASCII number between 0 and 2047 representing the channel number.
<PN>	The PN sequence offset of the active pilot as ASCII (0 - 511).
<SID>	0-32767 Cellular System ID.
<NID>	0-65535 Cellular Network ID.
<RSSI>	Signal strength in dBm e.g: -52dbm etc.

**Table 3-53: +NETPAR Parameters (Cont.)**

<Parameter>	Description
<Ec/Io>	Page Channel active pilot Ec/Io value.- Value is represented in (-1/2) dBm units e.g: the returned value 60 refers to -30dBm.
<TX power>	Mobile terminating transmit mean power level - True value in dBm e.g: -52dbm etc.
<TX Adjust>	Tx gain adjustment value - Value is represented in 1/2 dBm units e.g: the returned value 60 refers to 30dBm.

## +MDISP, Display Information Sent from Network

This command is used to display characters that the network sends to the module. The unsolicited message "+MDISP: <alpha>" is sent from the C24 to the terminal when C24 receives information from the network.

Command Type	Syntax	Response/Action
Set	+MDISP=<state>	OK or: +CME ERROR: <err>
Read	+MDISP?	+MDISP=<state>  OK
Test	+MDISP=?	+MDISP: (list of supported <state>s) OK or: +CME ERROR: <err>

The following table shows the +MDISP parameters.

**Table 3-54: +MDISP Parameters**

<Parameter>	Description
<state>	This parameter hold the state of the feature: 0      Display is disabled (default value) 1      Display is enabled

### Example

```
AT+MDISP=?
+MDISP: (0-1)
OK
+MDISP: "XYZ:(0011)-12345678"
OK
```

## +MDORMANT, Set Dormant Indication

This command enable/disable the dormant indication unsolicited report.

In case this feature is enabled, an unsolicited report will be displayed when the device switches to dormant mode. The user will have the ability to switch immediately to dormant mode by Execute Mode.

- Notes:**
- In case of Packet data mode or ODM no unsolicited report will be displayed.
  - In case of MUX mode, the data mode will remain and the unsolicited report will appear in channel 2 (command channel).

This command defines the dormant operation.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+MDORMANT=&lt;mode&gt;</b>	<b>OK</b> or: <b>ERROR: &lt;error_code&gt;</b>	In case the module switch to dormant mode: Unsolicited report of +MDORMANT: "Dormant Mode state" will be displayed.
<b>Read</b>	<b>+MDORMANT?</b>	<b>+MDORMANT: &lt;mode&gt;</b> <b>OK</b> or: <b>ERROR: &lt;error_code&gt;</b>	
<b>Test</b>	<b>+MDORMANT=?</b>	<b>+MDORMANT: &lt;list of supported mode&gt;</b> <b>OK</b> or: <b>ERROR: &lt;error_code&gt;</b>	
<b>Execute</b>	<b>+MDORMANT</b>	<b>OK</b> or: <b>ERROR: &lt;error_code&gt;</b>	In case the module switches to dormant mode immediately, the unsolicited report will appear based on <mode> value.

The following table shows the +MDORMANT parameters.

**Table 3-55: +MDORMANT Parameters**

<Parameter>	Description
<b>&lt;mode&gt;</b>	0 - Disable (Default) 1 - Enable

## +MPREFMODE, Set Preferred Mode

This command configures System Select setting. It is defined for Verizon operator.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MPREFMODE=<mode>	OK or: ERROR: <error_code>	
<b>Read</b>	+MPREFMODE?	+ MPREFMODE: <mode> OK	
<b>Test</b>	+MPREFMODE =?	+ MPREFMODE: (list of <mode>s) OK	

The following table shows the +MPREFMODE parameters.

**Table 3-56: +MPREFMODE Parameters**

<Parameter>	Description
<mode>	0 - Home Only 1 - Automatic 2 - Automatic A 3 - Automatic B The default value is 3. The value is saved after power down.

## +MBANDP, Select Preferred Band

This command enables the user to set the module to prefer a particular band (850 A, 850 B, PCS A, etc.) during a PRL scan.

This command allows the user to programmatically select a lesser preferred BSID with a better RSSI over a more preferred BSID with a weak RSSI.

**Note:** The user sets the preferred band. The PRL scan then excludes from its scan all bands other than the preferred band. If no BSID matches that band then the radio returns an error and does not register.

This command is defined for Aeris operator.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MBANDP =<band>	OK or: ERROR: <error_code>	
<b>Read</b>	AT+MBANDP?	+MBANDP: <band> OK	
<b>Test</b>	AT+MBANDP =?	+ MBANDP: (list of supported <band>'s) OK	

The following table shows the +MBANDP parameters.

**Table 3-57: +MBANDP Parameters**

<Parameter>	Description
<band>	0 Automatic (default) 1 Cellular CDMA A (800) 2 Cellular CDMA B (800) 3 PCS A (1900) 4 PCS B (1900) 5 PCS C (1900) 6 PCS D (1900) 7 PCS E (1900) 8 PCS F (1900) 9 PCS All (1900)

## UI (User Interface)

### +CLAN, ME Language

This command handles the selection of language in the ME.

The <code> parameter is a two-letter abbreviation of the language. The language codes, as defined in ISO 639, consist of two characters, e.g. "DE", "EN" etc.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CLAN=<code>	<b>OK</b> or: <b>ERROR</b>	Set command sets the selected language.
<b>Read</b>	+CLAN?	+CLAN: <code> <b>OK</b>	The read command displays the currently selected language.
<b>Test</b>	+CLAN=?	+CLAN: (list of <code>s) <b>OK</b>	Test command displays a list of supported language <code>s.

The following table shows the +CLAN parameters.

**Table 3-58: +CLAN Parameters**

<code>	Description
<b>DE</b>	German
<b>EN</b>	English
<b>IT</b>	Italian
<b>FR</b>	French
<b>ES</b>	Spanish
<b>NL</b>	Dutch
<b>SW</b>	Swedish
<b>DA</b>	Danish
<b>PT</b>	Portuguese
<b>FI</b>	Finnish
<b>NO</b>	Norwegian
<b>EL</b>	Greek
<b>TR</b>	Turkish

**Example**

```

AT+CLAN?
+CLAN: "EN"
OK
AT+CLAN=?
+CLAN: "DE","EN","IT","FR","ES","NL","SW","DA","PT","FI","NO","EL","TR"
OK
AT+CLAN="DE"
OK
AT+CLAN?
+CLAN: "DE"
OK

```

**+CMER, Mobile Equipment Event Reporting**

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CMER=[<mode>[,<keyp>[,<disp>[,<ind>[,<bfr>]]]]]	OK or: +CME ERROR: <err>	The Set command enables/disables an external accessory to receive event reports from the C24. In some cases, this is used to track the user activity for redisplay on a vehicle system, or to perform accessory-specific menu operations.
<b>Read</b>	+CMER?	+CMER: <mode>,<keyp>,<disp>,<ind>,<bfr> OK or: +CME ERROR: <err>	The Read command queries the current settings for the AT+CMER command.
<b>Test</b>	+CMER=?	+CMER: (list of supported <mode>s),(list of supported <keyp>s),(list of supported <disp>s),(list of supported <ind>s),(list of supported <bfr>s)	The Test command returns the possible <mode>, <keyp>, <disp>, <ind>, and <bfr> values.

The following table shows the +CMER parameters.

**Table 3-59: +CMER Parameters**

<Parameter>	Description
<mode>	Controls the processing of unsolicited result codes specified within this command. 0 Buffer unsolicited result codes in C24
<keyp>	0 Reserved for future implementation.
<disp>	0 Reserved for future implementation.

**Table 3-59: +CMER Parameters (Cont.)**

<Parameter>	Description
<ind>	0 No indicator events reporting. 1 Indicator event +CIEV: <ind>,<value>. <ind> shows the indicator order number and <value> is a new value of indicator. The default value is 0.
<bfr>	Controls the effect on buffered codes. 0 Clear buffer.

## +CIEV, Indicator Event Reporting

When a C24 indication is changed and the <ind> parameter of the +CMER command is set to 1, the +CIEV indication is sent to the DTE.

### Unsolicited Report

+CIEV: <ind>,<value>

The following table shows the +CIEV parameters.

**Table 3-60: +CIEV Parameters**

<ind>	Description	<value> Range	Explanation
<b>0</b>	Battery indicator	0-5	0 Low battery 5 Full battery
<b>1</b>	Signal bars	0-5	0 No signal 1 Low signal strength 5 High signal strength
<b>2</b>	Service availability	0/1	0 Service available 1 Service not available
<b>3</b>	Unread message indication	0/1	0 No unread messages 1 Unread messages exist
<b>4</b>	Call in progress	0/1	0 Call not in progress 1 Call in progress
<b>5</b>	Roaming indicator	0/1	0 Not roaming 1 Roaming
<b>6</b>	R-UIM Pin 1 requested	0/1	0 R-UIM pin ready 1 R-UIM pin required <b>Note:</b> Not supported in non-RUIM module, no value should return.



**Table 3-60: +CIEV Parameters (Cont.)**

<ind>	Description	<value> Range	Explanation
<b>7</b>	SMS storage full	0/1	0 SMS storage is not full 1 SMS storage is full <b>Note:</b> In case of non-RUIM module the SMS storage refers to IM memory.
<b>12</b>	R-UIM insertion/removal indication	0/1	0 R-UIM card removed from phone 1 R-UIM card inserted into phone <b>Note:</b> Not supported in non-RUIM module, no value should return.

## +MMR, Motorola Master Reset

This command sets the device back to manufacturers default.

Command Type	Syntax	Response/Action	Remarks
<b>Execute</b>	<b>+MMR</b>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	Performs Master Reset of the C24.

## +MMRR, Motorola Master Reset Reporting

This unsolicited message is sent to the DTE by the C24 if a master reset occurs, and master reset events reporting is enabled. The DTE is able to enable or disable this reporting.

Command Type	Syntax	Response/Action	Remarks
Set	+MMRR=<mode>	OK or: +CME ERROR: <err>	Enables/disables the reporting of master reset occurrences in the C24.
Read	+MMRR?	+MMRR: <mode> OK or: +CME ERROR: <err>	The Read command queries the current settings for the AT+MMRR command.
Test	+MMRR=?	+MMRR: (list of supported <mode>s) OK	The Test command returns the possible <mode>s values.

The following table shows the +MMRR parameters.

**Table 3-61: +MMRR Parameters**

<Parameter>	Description
<mode>	0 Disable master reset event reporting (default value). 1 Enable master reset event reporting.

### Example

```
AT+MMRR=1
OK
```

```
+MMRR                //Master reset event
```

## +CIND, Indicator Control

This command is used to query the status of various ME indicators.

+CIND: <service>,<call>,<recmsg>,<Roam>,<signal>,<smsfull>

Command Type	Syntax	Response/Action	Remarks
<b>Read</b>	AT+CIND?	+CIND:<ind>,<ind>....	Read command returns the status of ME indicators.
<b>Test</b>	AT+CIND=?	+CIND :(<descr>,(list of supported <ind>s)) ,(<descr>,(list of supported<ind>s))... OK	Test command returns pairs, where string value <descr> is a short description of the indicator and compound value is the allowed values for the indicator.

The following table shows the +CIND parameters.

**Table 3-62: +CIND Parameters**

<Parameter>	Description
<service>	0 Service not available. 1 Service available.
<call>	0 No call in progress. 1 Call in progress.
<recsms>	0 No unread messages. 1 Unread messages exist.
<ruimav>	0 No R-UIM card available. - related with non R-UIM module too. 1 R-UIM card is inserted.
<roam>	0 ME is camped on a home network. 1 ME is roaming.
<signal>	0 ME has no service. 1 ME has 1 bar of signal strength. 2 ME has 2 bars of signal strength. 3 ME has 3 bars of signal strength. 4 ME has 4 bars of signal strength. 5 ME has 5 bars of signal strength.
<smsfull>	0 SMS storage is not full. 1 SMS storage is full.

### Example

AT+CIND=?

+CIND:

("service",(0,1)),"call",(0,1)),"recmsg",(0,1)),"ruimav",(0,1)),"Roam",(0-2)),"signal",(0-5)),"smsfull", (0,1))

OK  
AT+CIND?  
+CIND: 1,0,0,0,0,5,0  
OK  
ATD 035684469;  
OK  
CONNECT  
AT+CIND?  
+CIND: 1,1,0,0,0,5,0  
OK



## Access

### +MPIN, Unlock Phone

This command enables the accessory application to unlock the phone when the appropriate unlock code has been provided.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MPIN=<unlock code>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	Executes the command to unlock the phone.
<b>Read</b>	+MPIN?	+MPIN: <mode> <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	Returns an integer indicating whether the phone unlock code is required. This is an independent phone lock status check only.

The following table shows the +MPIN parameters.

**Table 3-63: +MPIN Parameters**

<Parameter>	Description
<unlock code>	Current unlock code.
<mode>	READY      Phone is not waiting for an unlock code. UNLOCK CODE      Phone is waiting for the unlock code.

**Note:** When the MDN is changed, the security lock code must be changed to the last four digits of the new MDN.

#### Example

```

AT+MPIN?
+MPIN: UNLOCK CODE
OK
AT+MPIN="1234"           //Unlock, lock code is "1234"
OK
AT+MPIN?
+MPIN: READY
OK
AT+MPIN="1234"           //Attempt to unlock when not locked, OK is returned
OK
AT+MPIN?
+MPIN: READY
OK

```

## A/, Repeat Last Command

This command repeats the last command. It is not necessary to press <Enter> after this command.

Command Type	Syntax	Response/Action
Execute	A/	Repeats last command

### Example

```
AT&D?  
&D: 2  
OK  
A/  
&D: 2  
OK
```

## AT, Check AT Communication

This command only returns OK.

Command Type	Syntax	Response/Action
Execute	AT	OK

### Example

```
AT  
OK
```

## +CPIN, Enter PIN for Unlocking R-UIM Card or Enter PUK for Unlocking R-UIM Card

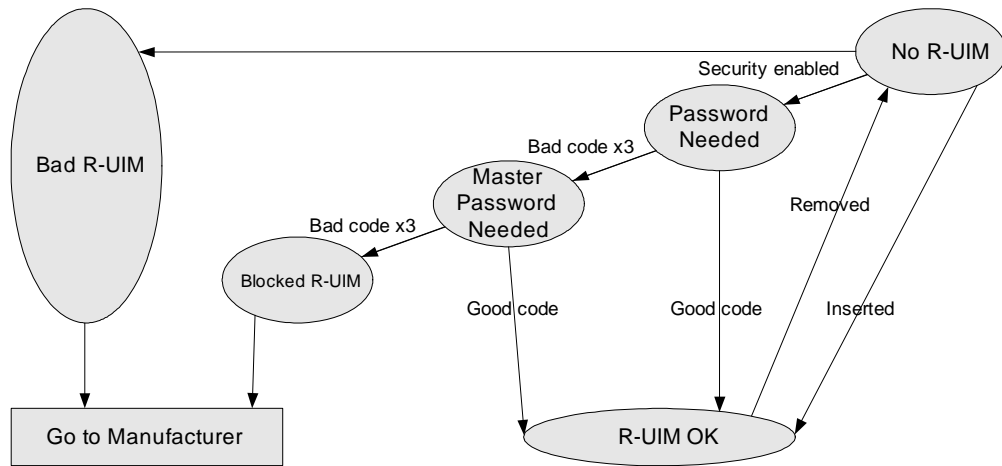
This command unlocks the R-UIM card when the proper R-UIM PIN is provided and unblocks the R-UIM card when the proper R-UIM PUK is provided.

**Note:** In case of non R-UIM Module, this command will return CME Error: "operation not supported".

The R-UIM card is unlocked only once the provided pin is verified as the R-UIM PIN. If the required PIN (determined by the error code returned from the requested operation or the Read command) is R-UIM PUK or R-UIM PUK2, the second pin is required. This second pin, <newpin>, is used to replace the old pin in the R-UIM card. When entering the pin, a <new pin> is not required.

**Note:** The R-UIM card lock is another level of security independent of the phone lock.

Figure 3-2 presents a diagram of what occurs when using the R-UIM card. Note that if an incorrect password is entered three times, the C24 requires that a master password be entered, if this also fails three times, the R-UIM will be blocked, and you will have to go to your provider to unblock.



**Figure 3-2: R-UIM States**

A R-UIM card related error is returned if an AT command operation is unsuccessful due to a R-UIM card problem. The following table shows the R-UIM card errors.

**Table 3-64: R-UIM Card Errors**

Error	Description
10 R-UIM not inserted	R-UIM Card is not inserted
11 R-UIM PIN required	R-UIM Card waiting for R-UIM PIN to be entered
12 R-UIM PUK required	R-UIM PIN is blocked
13 R-UIM failure	R-UIM Card is permanently blocked
18 R-UIM PUK2 required	R-UIM PIN2 is blocked

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CPIN=[<puk> or <pin>], [<newpin>]	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command sends the password to the C24 that is necessary before it can be operated (R-UIM PIN or R-UIM PUK). If there is no PIN request pending, no action is taken towards the C24, and an error message, +CME ERROR, is returned to the terminal. The Set command issued gives the code (R-UIM PIN or R-UIM PUK) corresponding to the error code required or returned as the result of the Read command. For example, if the R-UIM PIN is blocked, the error code 11 or "R-UIM PIN required" is returned. The user must then issue the Set command with the R-UIM PIN.
<b>Read</b>	AT+CPIN?	<b>+CPIN: &lt;code&gt;</b> <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Read command returns an alphanumeric string indicating the status of the R-UIM card, and whether a password is required or not. This is an independent R-UIM card lock status check only, and does not check the phone lock status.
<b>Test</b>	AT+CPIN=?	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	

The following table shows the +CPIN parameters.

**Table 3-65: +CPIN Parameters**

<Parameter>	Description
<b>&lt;puk&gt;</b>	PUK code for unblocking a blocked R-UIM.
<b>&lt;pin&gt;</b>	Current PIN for unlocking a locked R-UIM.
<b>&lt;newpin&gt;</b>	New PIN (after changing or after entering PUK) 4 - 8 digits.
<b>&lt;code&gt;</b>	READY - Not waiting for a password. R-UIM PIN - Waiting for R-UIM PIN. R-UIM PUK - Waiting for R-UIM PUK. R-UIM PUK2 - Waiting for R-UIM PUK2, this response is given when the last executed command resulted in PUK2 authentication failure.
<b>R-UIM PIN R-UIM PUK R-UIM PUK2 R-UIM PIN 2</b>	AT+CPIN=<pin> AT+CPIN=<puk>,<newpin> AT+CPIN=<puk2>,<newpin2> AT+CPIN=<pin2>



**Example**

AT+CPIN=?

OK

AT+CLCK="SC",1,"<correct PIN>"//Not case-sensitive

OK

The facility is enabled by the +CLCK command (Refer to “+CLCK, Facility Lock” on page 3-111)

AT+CPIN?

+CPIN: R-UIM PIN

OK

AT+CPIN="<correct PIN>"

OK

AT+CPIN?

+CPIN: READY

OK

The status of the R-UIM is still enabled, but the PIN is READY for this session.

The R-UIM is enabled per session. After power-up R-UIM must be unlocked again by using the +CLCK command.

The following case shows an example of three unsuccessful attempts at entering the PIN:

AT+CPIN?

+CPIN: R-UIM PIN

OK

AT+CPIN="<wrong pin>"

+CME ERROR: incorrect password

AT+CPIN="<wrong pin>"

+CME ERROR: incorrect password

AT+CPIN="<wrong pin>"

+CME ERROR: R-UIM PUK required

AT+CPIN?

+CPIN: R-UIM PUK

//PIN is blocked. The PUK is needed for unblocking.

OK

AT+CPIN="<PUK>","<NEW PIN>" //Enter PUK and new PIN

OK

AT+CPIN?

+CPIN: R-UIM PUK2

//PIN2 is blocked. The PUK2 is needed for unlocking.

OK

AT+CPIN="<PUK2>","<NEW PIN2>" //Enter PUK2 and new PIN2

OK

**+EPIN, Enter R-UIM PIN2 to Verify PIN2 Indicator**

This AT command will be used to verify the PIN2 when the proper R-UIM PIN2 password has been provided. The code presented by the ME PIN2 password will be compared with the relevant one stored in the R-UIM. The execution of this command is possible only if the R-UIM is in READY state or waiting for PIN2 state. If the PIN2 presented is correct, the number of remaining PIN2 attempts will be reset to its initial value allowed by the service provider. If the PIN2 presented is false, the number of remaining PIN2 attempts will be decremented. If an incorrect password is entered for maximum attempts allowed by provider, the R-UIM will be blocked, and

the user will have to unblock it. To unblock the R-UIM card, the user can use the AT+CPIN command.

**Note:** In case of non R-UIM Module, this command will return CME Error: "operation not supported".

Command Type	Syntax	Response/Action	Remarks
Set	AT+EPIN=<type>,<passwd>	OK or: +CME ERROR: <err>	
Test	AT+EPIN=?	+EPIN: possible list of <type> OK	

The following table shows the +EPIN parameters.

**Table 3-66: +EPIN Parameters**

<Parameter>	Description
<type>	Digit type value, that indicate what action need to be execute.  2 - Verify PIN2 indicator.
<passwd>	String type. PIN2 password 4 - 8 digits.

#### Example

```
AT+EPIN=?  
+EPIN: 2  
OK
```

```
AT+EPIN=2,"<wrong_passwd>"  
+CME ERROR: incorrect password
```

```
AT+EPIN=1,"<passwd>"  
+CME ERROR: not supported
```

```
AT+EPIN=2,"<correct_passwd>"  
OK
```

## +TPIN, Query Number of Remaining R-UIM PIN/PUK Entering Attempts

This command returns the number of remaining attempts of entering the PIN and PUK for the R-UIM card in use. The command returns the number of remaining attempts for PIN1 (CHV1),

PIN2 (CHV2), PUK1 (unlock CHV1) and PUK2 (unlock CHV2). Number of available attempts is provider dependant. Typically it is 3 attempts for PIN, 10 attempts for PUK.

**Note:** In case of non R-UIM Module this command will return CME Error: "operation not supported".

This command will return error if R-UIM is not inserted.

Command Type	Syntax	Response/Action	Remarks
Read	AT+TPIN?	+TPIN:<chv1>, <unb1_chv1>,<chv2>, <unb1_chv2> or ERROR	

The following table shows the +TPIN parameters.

**Table 3-67: +TPIN Parameters**

<Parameter>	Description
<chv1>	Number of remaining PIN attempts
<chv2>	Number of remaining PIN2 attempts
<unb1_chv1>	Number of remaining PUK attempts
<unb1_chv2>	Number of remaining PUK2 attempts

### Example

```
AT+TPIN=?
+TPIN: 3,10,3,10
OK
AT+CPIN="7777"
+CME ERROR: incorrect password
AT+TPIN?
+TPIN: 2,10,3,10
OK
```

## +CPWD, Change Password

This command sets a new password for the facility lock. The password can only be changed once the required facility is enabled by the +CLCK command. (Refer to ["+CLCK, Facility Lock"](#) on page 3-111).

A password can be changed only if the provided password <oldpwd> has been verified. The entered password <newpwd> must also comply to the password rules. The facility value <fac> is not case-sensitive. In the password value, letters are not allowed.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CPWD=<fac>,<oldpwd>,<newpwd>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets a new password for the facility lock function, defined by the +CLCK command. (Refer to “+CLCK, Facility Lock” on page 3-111).
<b>Read</b>	AT+CPWD?	<b>+CME ERROR: &lt;err&gt;</b>	
<b>Test</b>	AT+CPWD=?	<b>+CPWD:list of supported (&lt;fac&gt;,&lt;pwdlength&gt;)s</b> <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Test command returns a list of pairs which represent the available facilities, and the maximum length of their passwords.

The following table shows the +CPWD parameters.

**Table 3-68: +CPWD Parameters**

<Parameter>	Description
<b>&lt;fac&gt;</b>	List of supported facilities. PL Phone lock/unlock code SC R-UIM PIN code AB All Barring services P2 R-UIM PIN2 <b>Note:</b> In case of non R-UIM Module, trying to use SC or P2, <fac> will return CME Error: "Operation not supported".
<b>&lt;oldpwd&gt;</b>	String type, 4-8 character password specified for the facility from the C24 user interface.
<b>&lt;newpwd&gt;</b>	String type, 4-8 character new password specified by the user.
<b>&lt;pwdlength&gt;</b>	Maximum length of the facility password. Integer type.

### Example

```
AT+CPWD=?
+CMPWD: ("SC",8),("PL",4),("AB",4),("P2",8)
OK
AT+CPWD?
+CME ERROR: operation not supported
AT+CLCK: "sc",1,"current pin password"
AT+CPWD="sc","incorrect old password","new password"
+CME ERROR: incorrect password

AT+CPWD="sc","old password","new password"
```

+CME ERROR: operation not allowed

AT+CPWD="p2","old password","new password"  
OK

AT+CLCK="ai",1,"correct password"  
OK

AT+CPWD="ab","old password","new password"  
OK

## +CLCK, Facility Lock

This command locks, unlocks or interrogates a C24 facility <fac> (any kind of call barring program). A password is mandatory for performing locking and unlocking actions, but not for querying. The feature of the C24 that affected by this is the fixed dialing list. When querying the status of a single call barring program <mode>=2, the <status> for each call type will be returned.

For <fac>="SC", R-UIM PIN setting and for <fac>="PL" Phone Lock setting, the class is irrelevant (For more information about <class>, refer to the following table shows the +CLCK parameters.).

The <passwd> for "SC" is R-UIM PIN, for "PL" is Phone Lock Code.

**Note:** When the phone is in state of code required ("PL" is enable) and also the R-UIM PIN is required ("SC" is enable), first the phone should be unlock (see the command +MPIN) and after the R-UIM (see the command +CPIN).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CLCK=<fac>,<mode> [,<passwd> [,<class>]]	For <fac> where <class> is irrelevant: +CLCK=<fac>,2 +CLCK: <status> For <fac> with several supported <class>es: +CLCK=<fac>,2 +CLCK: <status>,<class1> <CR><LF> +CLCK: <status>,<class2> .... OK	The Set command performs the specified <mode> action on the specified <fac>.  <b>Note:</b> In case of non R-UIM Module trying to use SC <fac> will return CME Error: "Operation not supported".
<b>Read</b>	+CLCK?	+CLCK: ERROR	
<b>Test</b>	+CLCK=?	+CLCK: (list of supported <fac>s)	The Test command returns the list of supported facilities.

The following table shows the +CLCK parameters.

**Table 3-69: +CLCK Parameters**

<Parameter>	Description
<fac>	SC R-UIM Card PIN setting - not applicable in non-R-UIM module <mode>0 Disable PIN 1 Enable PIN) PL Phone Lock/Unlock setting <mode>0Disable code 1Enable code AO BAOC (Bar All Outgoing Calls) OI BOIC (Bar Outgoing International Calls) OX BOIC-exHC (Bar Outgoing International Calls except to Home Country) AI BAIC (Bar All Incoming Calls) AB All Barring services (applicable only for <mode>=0) AG All outgoing barring services (applicable only for <mode>=0)
<mode>	0 Disable 1 Enable 2 Query status (<passwd> does not apply)
<passwd>	String type, 4-8 character password
<class>	Sum of integers, each representing a class of information <class>. Only applies to call barring related facilities. 1 Voice (telephony) 2 Data (refers to all bearer services) 4 Fax (facsimile services) 8 SMS (Short Message Services) The default value is 7.
<status>	0 Inactive 1 Active

### Example

```

AT+CLCK=?
+CLCK: ("SC","PL","AO","OI","AI","AB")
OK
AT+CLCK="SC",2
+CLCK: 0
OK
AT+CLCK="SC",1
+CME ERROR: operation not allowed
AT+CLCK="SC",1,"incorrect password"
+CME ERROR: incorrect password
AT+CLCK="SC",1,"correct password"
OK
(From now R-UIM Card is locked and PIN is requested on power up)
AT+CLCK="AB",0,"incorrect password"
+CME ERROR: incorrect password
AT+CLCK="OI",2
+CLCK: 0,1

```

```

+CLCK: 0,2
+CLCK: 0,4
+CLCK: 0,8
OK
AT+CLCK="OI",1,"correct password",3
OK
AT+CLCK="OI",2
+CLCK: 1,1
+CLCK: 1,2
+CLCK: 0,4
+CLCK: 0,8
OK
AT+CLCK="AO",1,"correct password" //When no class the default is 7
AT+CLCK="AO",2
+CLCK: 1,1
+CLCK: 1,2
+CLCK: 1,4
+CLCK: 0,8
OK

```

## +MMRU, Restricted R-UIM Access

This command provides limited access to the Elementary Files on the R-UIM. Access to the R-UIM database is restricted to the commands that listed at <command>. All parameters of AT+MMRU are used as specified by Removable User Identity Module (R-UIM) for CDMA. As response to the command, the C24 sends the actual R-UIM information parameters and response data. Error result code "+CME ERROR" may be returned if the command cannot be transferred to the R-UIM, e.g. if the R-UIM is not inserted, or defected, or PIN1/PUK authentication required, or required input parameters not present. However, failure in the execution of the command in the R-UIM is reported in <sw1> and <sw2> parameters.

Some of the AT+MMRU commands require PIN/PIN2 authentication.

**Note:** In case of non R-UIM Module this command will return CME Error: "Operation not supported".

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MMRU=<command>,[<file_id>,<P1>,<P2>,<P3>[,<data>]]	+MMRU: <sw1>,<sw2>[,<response>] <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	Set command transmits the R-UIM <command> and its required parameters to the ME. ME sends the actual R-UIM information parameters and response data.
<b>Test</b>	AT+MMRU=?	+MMRU: (list of supported <command>s), (possible <file_id>s range value), (possible <P1> range value), (possible <P2> range value), (possible <P3>range value), <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The test command returns the possible ranges of MMRU parameters.

The following table shows the +MMRU parameters.

**Table 3-70: +MMRU Parameters**

<Parameter>	Description
<b>&lt;command&gt;</b>	Integer type. Command passed on by the ME to the R-UIM.  176 Read BINARY 178 Read RECORD 192 Get RESPONSE 214 Update BINARY 220 Update RECORD 242 STATUS
<b>&lt;file_id&gt;</b>	Integer type. This is the identifier of a elementary data file on R-UIM. Mandatory for every <command> except of STATUS.



**Table 3-70: +MMRU Parameters (Cont.)**

<Parameter>	Description
<P1>,<P2>,<P3>	<p>Integer type. Parameters passed on by the ME to the R-UIM. These parameters are mandatory for every command, except GET RESPONSE and STATUS.</p> <p><b>READ BINARY</b></p> <p>&lt;P1&gt; Offset high (0...255)            &lt;P2&gt; Offset low (0...255)            &lt;P3&gt; Length (0...255)</p> <p><b>READ RECORD</b></p> <p>&lt;P1&gt; Rec. No. (0...255)            &lt;P2&gt; Mode    "02" = next record                          "03" = previous record                          "04" = absolute mode/current mode, the record number is given in P1 with P1='00' denoting the current record.            &lt;P3&gt; Length (0...255)</p> <p><b>GET RESPONSE</b></p> <p>&lt;P1&gt; "00"            &lt;P2&gt; "00"            &lt;P3&gt; Length (0...255)</p> <p><b>UPDATE BINARY</b></p> <p>&lt;P1&gt; Offset high (0...255)            &lt;P2&gt; Offset low (0...255)            &lt;P3&gt; Length (0...255)</p> <p><b>UPDATE RECORD</b></p> <p>&lt;P1&gt; Rec. No. (0...255)            &lt;P2&gt; Mode    "02" = next record                          "03" = previous record                          "04" = absolute mode/current mode, the record number is given in P1 with P1='00' denoting the current record.            &lt;P3&gt; Length (0...255)</p> <p><b>STATUS</b></p> <p>&lt;P1&gt; "00"            &lt;P2&gt; "00"            &lt;P3&gt; Length (0...255)</p>
<data>	<p>Information which shall be written to the R-UIM (hexadecimal character format). Mandatory for UPDATE BINARY and UPDATE RECORD.</p>

**Table 3-70: +MMRU Parameters (Cont.)**

<Parameter>	Description																																																							
<sw1> <sw2>	<p>Integer character format. Information, from the R-UIM, about the execution of the actual command. These parameters are delivered to the TE in both cases, on successful or failed execution of the command.</p> <p>Responses to commands which are correctly executed:</p> <table border="1"> <thead> <tr> <th>&lt;sw1&gt;</th><th>&lt;sw2&gt;</th><th>Description</th></tr> </thead> <tbody> <tr> <td>144</td><td>0</td><td>Normal ending of the command</td></tr> <tr> <td>145</td><td>XX</td><td>Normal ending of the command, with extra information from the proactive R-UIM, containing a command for the ME. Length 'XX' of the response data.</td></tr> <tr> <td>158</td><td>XX</td><td>Length 'XX' of the response data given in case of a R-UIM data download error.</td></tr> <tr> <td>159</td><td>XX</td><td>Length 'XX' of the response data.</td></tr> </tbody> </table> <p>Responses to commands which are postponed:</p> <table border="1"> <thead> <tr> <th>&lt;sw1&gt;</th><th>&lt;sw2&gt;</th><th>Error Description</th></tr> </thead> <tbody> <tr> <td>147</td><td>0</td><td>R-UIM Application Toolkit is busy. Command cannot be executed at present, further normal commands are allowed.</td></tr> <tr> <td>146</td><td>0X</td><td>Command successful but after using an internal update retry routine 'X' times.</td></tr> <tr> <td>146</td><td>64</td><td>Memory problem.</td></tr> <tr> <td>148</td><td>0</td><td>No EF selected.</td></tr> <tr> <td>148</td><td>2</td><td>Out of range (invalid address).</td></tr> <tr> <td>148</td><td>4</td><td> <ul style="list-style-type: none"> <li>File ID not found.</li> <li>Pattern not found.</li> </ul> </td></tr> <tr> <td>148</td><td>8</td><td>File is inconsistent with the command</td></tr> <tr> <td>152</td><td>2</td><td>No CHV initialized</td></tr> <tr> <td>152</td><td>4</td><td> <ul style="list-style-type: none"> <li>Access condition not fulfilled.</li> <li>Unsuccessful CHV verification, at least one attempt left.</li> <li>Unsuccessful UNBLOCK CHV verification, at least one attempt left.</li> <li>Authentication failed.</li> </ul> </td></tr> <tr> <td>152</td><td>8</td><td>In contradiction with CHV status.</td></tr> <tr> <td>152</td><td>16</td><td>In contradiction with invalidation status.</td></tr> <tr> <td>152</td><td>64</td><td> <ul style="list-style-type: none"> <li>Unsuccessful CHV verification, no attempt left.</li> <li>Unsuccessful UNBLOCK CHV verification, no attempt left.</li> <li>CHV blocked.</li> <li>UNBLOCK CHV blocked.</li> </ul> </td></tr> </tbody> </table>		<sw1>	<sw2>	Description	144	0	Normal ending of the command	145	XX	Normal ending of the command, with extra information from the proactive R-UIM, containing a command for the ME. Length 'XX' of the response data.	158	XX	Length 'XX' of the response data given in case of a R-UIM data download error.	159	XX	Length 'XX' of the response data.	<sw1>	<sw2>	Error Description	147	0	R-UIM Application Toolkit is busy. Command cannot be executed at present, further normal commands are allowed.	146	0X	Command successful but after using an internal update retry routine 'X' times.	146	64	Memory problem.	148	0	No EF selected.	148	2	Out of range (invalid address).	148	4	<ul style="list-style-type: none"> <li>File ID not found.</li> <li>Pattern not found.</li> </ul>	148	8	File is inconsistent with the command	152	2	No CHV initialized	152	4	<ul style="list-style-type: none"> <li>Access condition not fulfilled.</li> <li>Unsuccessful CHV verification, at least one attempt left.</li> <li>Unsuccessful UNBLOCK CHV verification, at least one attempt left.</li> <li>Authentication failed.</li> </ul>	152	8	In contradiction with CHV status.	152	16	In contradiction with invalidation status.	152	64	<ul style="list-style-type: none"> <li>Unsuccessful CHV verification, no attempt left.</li> <li>Unsuccessful UNBLOCK CHV verification, no attempt left.</li> <li>CHV blocked.</li> <li>UNBLOCK CHV blocked.</li> </ul>
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**Table 3-70: +MMRU Parameters (Cont.)**

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109	XX	Unknown instruction code given in the command.																				
110	XX	Wrong instruction class given in the command.																				
111	XX	Technical problem with no diagnostic given.																				
<response>	Response of a successful completion of the command previously issued (hexadecimal character uppercase format). STATUS and GET RESPONSE return data, which gives information about the current elementary data file_id. This information includes the type of file and its size. After READ BINARY or READ RECORD command, the requested data will be returned. <response> is not returned after a successful UPDATE BINARY or UPDATE RECORD command.																					

**Example**

```

AT+MMRU=178,28474,1,4,26          //READ RECORD, ADN file(6F3A) data, 1, current, 26 bytes
+MMRU: 144,0,72656FFFFFFFFFFFFFFFF06818984143243FFFFFFFFFFFFFFFF
                                     //Generic success code, 26 bytes data of the 1st record

OK
AT+MMRU=192,12258                  //GET RESPONSE, ICCID(2fe2)

+MMRU: 144,0,0000000A2FE20400B00BB01020000
                                     //Generic success code, 0000-> RFU 000A->File size 2FE2-> File ID
04-> Type of the file (EF) 00->RFU 0B00BB->Access conditions (READ=0-ALW, UPDATE=B-NEVER)
01->File status 02->Length of the following data (byte 14 to the end) 00->Structure of EF (transparent)
00->Length of a record (For cyclic and linear fixed EFs this byte denotes the length of a record. For a
transparent EF, this byte shall be coded '00')

OK

AT+MMRU=220,28474,1,4,30,
657469FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
                                     //UPDATE RECORD, ADN file(6F3A), 1st record, current, 30 bytes
data
+MMRU: 144,0                        //Generic success code

OK

AT+MMRU=?                          //Test Command
+MMRU=(176,178,192,214,220,242),(12037-28599),(0-255),(0-255),(0-255)
                                     //Possible values

```

## Phone Books and Clock

### Directory Access Commands - Phone Book

This set of commands enables read/write access to the phone book contained within the C24, including both the numeric and the alpha information contained in the location. The presentation is according to GSM 07.07.

In some cases, it may be possible to use these commands to access the dialed and received call stacks. However, as these phone books cannot be edited, the +CPBW command does not work on them.

#### +CPBS, Select Phone Book Memory

This command handles the selection of the memory to be used for reading and writing entries in the C24's phone books' memory. (When there is separate storage on the R-UIM card and in the C24's internal memory).

Command Type	Syntax	Response/Action	Remarks
Set	AT+CPBS=<storage>	OK or: +CME ERROR: <err>	The Set command selects the phone book memory storage which is to be used by other phone book commands.
Read	+CPBS?	+CPBS: <storage>[,<used>,<total>]	The Read command returns the currently selected phone book memory, number of used entries and total number of entries in the phone book memory.
Test	+CPBS=?	+CPBS: (list of supported <storage>s) OK	Test command returns the supported storages as a compound value.

The following table shows the +CPBS parameters.

**Table 3-71: +CPBS Parameters**

<Parameter>	Description
<storage>	<p>List of supported phone books and their storage IDs</p> <p>MT Combined C24 and R-UIM phone book.</p> <p>RM R-UIM phone book.</p> <p>ME C24 phone book.</p> <p>DC C24 or R-UIM dialed calls list. (depending on presence of R-UIM).</p> <p>RC C24 received calls list.</p> <p>MC C24 missed (unanswered received) calls list.</p> <p>SD C24 phone book (service dialing).</p> <p>ON C24 own numbers list.</p> <p>The default phone book is MT.</p>
<used>	Integer type value indicating the number of used locations in the selected memory.
<total>	<p>Integer type value indicating the total number of entries in the selected phone book memory.</p> <p>The range of values per Phone book:</p> <p>MT - 1-750 (R-UIM dependent)</p> <p>RM - 501-750 (R-UIM dependent)</p> <p>ME - 1-500</p> <p>DC - 1-10</p> <p>RC - 1-10</p> <p>MC - 1-10</p> <p>SD - 1-max , &lt;max&gt; is model dependent.</p> <p>ON - 1-3</p>

**Notes:**

- +CPBW is applicable for MC, RC, DC storages only for delete entry. (using <index>).
- In case that R-UIM card is not present, MT=ME.
- In case that R-UIM card is present, the C24 uses DC of R-UIM.
- The "SD" PB supports storage of up to 3 user programmable special numbers (model dependent).
- Special numbers ("SD" PB) are always able to be dialed, even when the device is locked.
- The "SD" PB includes Emergency numbers.

**Example**

AT+CPBS=?

+CPBS: ("ME","RM","MT","ON","DC","MC","RC","SD") // R-UIM is presented  
OK

AT+CPBS="RM"

OK

AT+CPBS=?

+CPBS: ("ME","MT","ON","DC","MC","RC","SD") // R-UIM isn't presented

OK

AT+CPBS="MT"

OK

## +CPBR, Read Phone Book Entries

This command recalls phone book entries from a specific entry number or from a range of entries. If only one entry is specified, and that entry is empty, OK is returned. If a range of entries is requested, all entries that contain data within that range are returned. If a listing fails in a C24 error, +CME ERROR: <err> is returned.

This command can also be used to obtain information about the number of entries and the maximum size of a phone number and alpha tag fields in the phone book.

This command acts on the currently active phone book, as selected with the +CPBS command (Refer to “+CPBS, Select Phone Book Memory”, page 3-118).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CPBR=<index1> [ <i>,&lt;index2&gt;</i> ]	[+CPBR: <index1>,<number>,<type>,<text> [<CR><LF> +CPBR: <index2>,<number>,<type>,<text>]] OK or: +CME ERROR: <err>	The Set command returns phone book entries.
<b>Test</b>	+CPBR=?	+CPBR: (list of supported <index>s),[<nlength>], [<tlength>] OK	The Test command returns the entry range supported by the current storage as a compound value and the maximum lengths of the <number> and <text> fields.

The following table shows the +CPBR parameters.

**Table 3-72: +CPBR Parameters**

<Parameter>	Description
<index1> <index2>	Index for a given phone book entry
<number>	Phone number of a given entry
<type>	The address type of a phone number 129    Use for local call 145    Use “+” for international access code 128    Unknown

**Table 3-72: +CPBR Parameters (Cont.)**

<Parameter>	Description
<text>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
<nlength>	The maximum number of digits in the <number>.
<tlength>	The maximum number of characters in the <text> entry

**Example**

```

AT+CPBS="ME"
OK
AT+CPBR=?
+CPBR: (1-500),40,24
OK
AT+CPBR=1
OK
AT+CPBR=1,3           //There is nothing written in entry 1,2,3
OK

```

**+CPBF, Find Phone Book Entries**

This execution command enables the user to search for a particular entry, by name, in the currently active phone book.

- If no matching entry is found, the command returns OK. If multiple matches are found, all are returned.
- Searching the address book **MUST** show entries with strings matching typed digits. For example typing the search string of "jo" **MUST** find both "John Smith" and "Mike Jones".
- The address book **MUST NOT** display partial matched strings. For example typing in "jo" **MUST NOT** find entries like "Maryjo".
- The address book **MUST** filter based on ASCII values, however it **MUST** allow for "jo" to be searched case insensitive. Displayed matches would be displayed as ASCII matches.

Command Type	Syntax	Response/Action
<b>Set</b>	+CPBF=<findtext>	[+CPBF: <index1>,<number>,<type>,<text>[[...] <CR><LF> +CBPF: <index2>,<number>,<type>,<text>]] OK or: +CME ERROR: <err>
<b>Test</b>	AT+CPBF=?	+CPBF: [<nlength>],[<tlength>] OK

The following table shows the +CPBF parameters.

**Table 3-73: +CPBF Parameters**

<Parameter>	Description
<findtext>	Case-sensitive text substring (even of one letter) to search for, according to the character set specified by the +CSCS command.
<index1> <index2>	Index for a given phone book entry.
<number>	Phone number of a given entry.
<type>	The address type of a phone number 129 Use for local call 145 Use "+" for international access code 128 Unknown
<text>	Text identifier for a phone book entry that starts with the substring <findtext>, according to the character set as specified by command +CSCS. In case the <findtext> is not empty the entries will be sorted by name.

#### Example

```

AT+CPBS="MT"           //Selecting phone book
OK
AT+CPBF="k"            //Searching for "k" and not finding it
OK
AT+CPBF="Voice"        //Searching for string "Voice" and finding Voice Mail
+CPBF: 101,"+97252999080",145,"Voice Mail"
OK
AT+CPBF=""             //Searching for everything in phone book, and finding all entries
+CPBF: 2,"8475767800",129,"Moto Voicemail"
+CPBF: 101,"+97252999080",145,"Voice Mail"
OK
AT+CPBF="Moto"
+CPBF: 2,"8475767800",129,"Moto Voicemail"

```

### +CPBW, Write Phone Book Entry

This command enables the user to store a new entry in the phone book, or edit/delete an existing entry from the phone book. A particular entry in the phone book can be stored, or the next available entry is used.

This command writes the entry in the currently active phone book, selected with the +CPBS command ([Refer to “+CPBS, Select Phone Book Memory”, page 3-118](#)).

The entry is selected by <index>, the phone number is entered into the <number> field and text associated with the number is entered into the <text> field. If these fields are omitted, the phone book entry is deleted. If the <index> field is omitted, but a number is entered in the <number> field, the phone number is entered into the first available entry in the phone book. If the <index> field already exists in the PB, the new record will update the old one. If the writing fails in a C24 error, +CME ERROR: <err> is returned.



Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CPBW=[<index>],[<number>],[<type>],[<text>]]	OK or: +CME ERROR: <err>	The user <u>can't write</u> the entries in <b>DC, RC and MC</b> PBs, but <u>can delete</u> (AT+CPBW=<index>).
<b>Test</b>	AT+CPBW=?	+CPBW: (list of supported <index>s),[<nlength>], (list of supported <type>s),[<tlength>] OK	This command queries the allowable command field and sizes.

The following table shows the +CPBW parameters.

**Table 3-74: +CPBW Parameters**

<Parameter>	Description
<index>	Index for a given phone book entry.
<number>	Phone number of a given entry.
<type>	The address type of a phone number 129 Use for local call 145 Use "+" for international access code 128 Unknown
<text>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
<nlength>	The maximum size of a phone number, in digits. There is a limited number of PB records that can be stored with this length. The number of "long" PB records depends on the size of the R-UIM card EXT1 extension file. If the extension file is full, an attempt to store a new record with more than 20 digits returns an error.
<tlength>	The maximum number of characters in the <text> entry. This applies to GSM standard characters only. Non-GSM standard character sets and extended GSM characters require additional space in storage. In some cases, when using such characters the text cannot be stored. In this case, the C24 returns a "text string too long" error.

### Example

```
AT+CBPS="ME"
OK
AT+CPBW=?
+CPBW: (1-500),40,(129,145),24
OK
AT+CPBW=1,"0546123456",129,"AAA"
OK
AT+CPBR=1
+CPBR: 1,"0546123456",129,"AAA"
```

```

AT+CPBW=1,"0546123456",129,"BBB"
OK
AT+CPBR=1
+CPBR: 1,"0546123456",129,"BBB"

```

## +CSVM, Set Voice Mail Server

This command handles the selection of the number to the voice mail server. The new value should also remain after power cycle.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CSVM=<mode> [ <b>,&lt;number&gt;</b> [ <b>,&lt;type&gt;</b> ]]	<b>OK</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the number to the voice mail server.
<b>Read</b>	+CSVM?	<b>+CSVM:&lt;mode&gt;,&lt;number&gt;</b> <b>,&lt;type&gt;</b> <b>+CME ERROR: &lt;err&gt;</b>	The Read command displays the currently selected voice mail number and status (enabled or disabled).
<b>Test</b>	+CSVM=?	<b>+CSVM: (list of supported &lt;mode&gt;s), (list of supported &lt;type&gt;s)</b> <b>+CME ERROR: &lt;err&gt;</b>	The Test command displays the list of supported <mode>s and <type>s.

The following table shows the +CSVM parameters.

**Table 3-75: +CSVM Parameters**

<Parameter>	Description
<b>&lt;mode&gt;</b>	0 Disables the voice mail number (default) 1 Enables the voice mail number
<b>&lt;number&gt;</b>	Voice mail number in string. String can be of up to 32 characters long, starting with a digit, or "+". Other allowed characters are digits only (0..9).
<b>&lt;type&gt;</b>	Address octet type. 129 ISDN/telephony marketing plan; national/international number unknown 145 ISDN/telephony numbering plan; international number When the dialing string includes the international access code character (+), the default is 145. Otherwise, the default <type> is 129.

**Notes:**

- If <mode> is set to 0, <number> and <type> are ignored. If <mode> is set to 1, <number> is mandatory.
- Sprint req.: When the MDN is changed, the voice mail access number must be changed to the new MDN.

**Example**

```
AT+CSVM=?
+CSVM: (0,1),(129,145)
OK
AT+CSVM=1,"+972555123456","145"
OK
AT+CSVM?
+CSVM: 1,"972555123456",145
OK
```

**System Date and Time Access Commands****+CCLK, Read/Set System Date and Time**

This command reads and sets the C24 current date, time and time zone.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+CCLK=&lt;time&gt;</b>	<b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the date, time and time zone of the system clock. Set Command sets user defined system clock values and saves them in the NVM memory. These saved values are kept after power-cycle as well.
<b>Read</b>	<b>+CCLK?</b>	<b>+CCLK: &lt;time&gt;</b> <b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The Read command returns the current date, time and time zone setting. By default, <time> will represent the network updated time. If the user has used the Set command once, then <time> will represent the Set command setting. If network operator does not support System Clock Update Message, the initial date, time and time zone, displayed by CCLK Read Command could be invalid (user's responsibility to set date, time and time zone by CCLK Set Command). See Execute Command for how-to enable back network update time.

Command Type	Syntax	Response/Action	Remarks
<b>Test</b>	<b>+CCLK=?</b>	<b>+CCLK (list of supported &lt;time&gt;s)</b> <b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The Test command returns valid parameters for the +CCLK Set command.
<b>Execute</b>	<b>+CCLK</b>	<b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The Execute command causes system clock to be overridden by network System Clock value immediately. CCLK Read command will represent the network update time after CCLK Execute command. This value will be represented after power-cycle as well.

The following table shows the +CCLK parameters.

**Table 3-76: +CCLK Parameters**

<Parameter>	Description
<b>&lt;time&gt;</b>	ASCII string of format: yy/MM/dd,hh:mm:ss±zz or yy/MM/dd,hh:mm:ss yy - 2-digit year [2000-2069] MM - 2-digit month [01-12] dd - 2-digit day of month [00-31] hh - 2-digit hour [00-23] mm - 2-digit minute [00-59] ss - 2-digit seconds [00-59] zz - (optional) time zone offset from GMT, in quarter-hours [-47...+48]. If this value is not specified, the time zone offset will be 0.

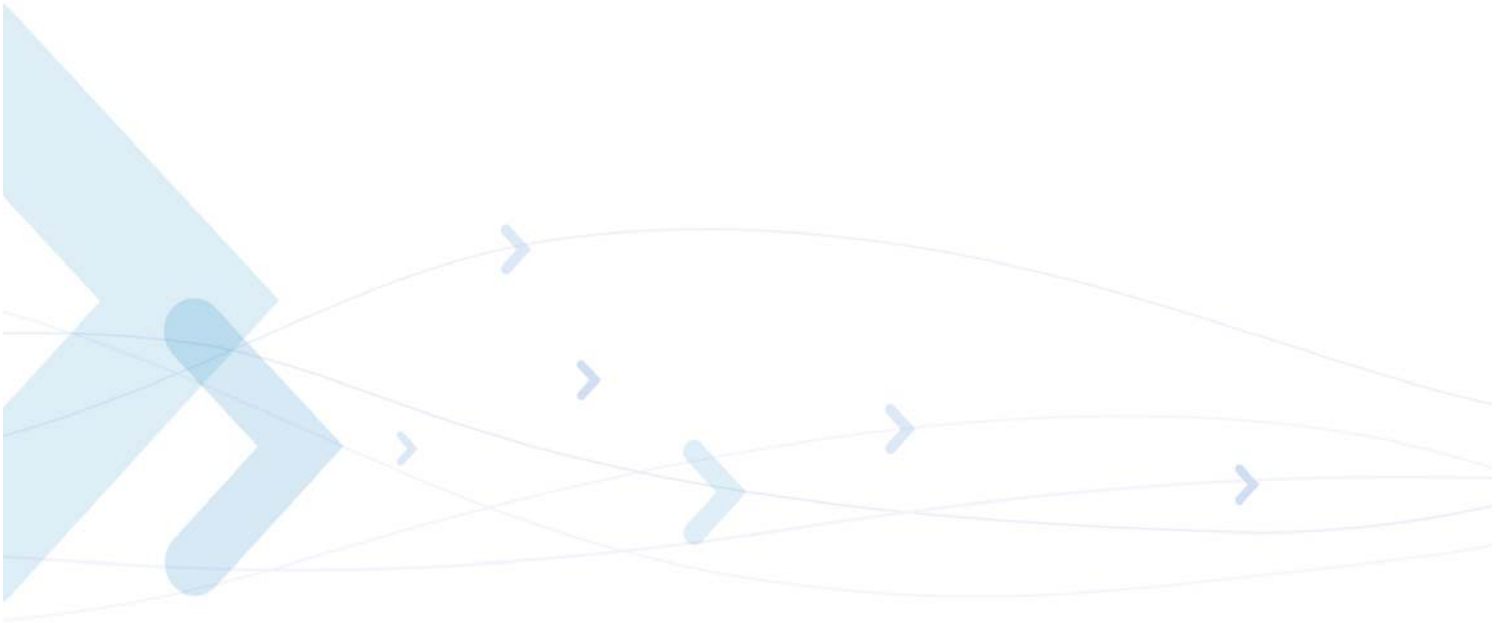
### Example

```

AT+CCLK=?
+CCLK: "88/12/31, 23:59:59, (-47-+48)"
OK
AT+CCLK="01/01/01, 01:01:01-08"
OK
AT+CCLK?
+CCLK: "01/01/01, 01:01:01-08"
OK
AT+CCLK="02/02/02, 02:02:02"
OK
Power cycling...
AT+CCLK?
+CCLK: "02/02/02, 02:02:02+00"
OK
AT+CCLK="03/03/03, 03:03:03+50"
+CME ERROR: Numeric parameter out of bounds
AT+CCLK
OK
AT+CCLK?

```

```
+CCLK: "05/10/27,16:52:31+08"  
Power cycling...  
AT+CCLK?  
+CCLK: "05/10/27,16:52:50+08"  
OK
```



## Facsimile Service Class 2.0

### Overview

A Service Class 2.0 facsimile C24 provides a level of services necessary to support Group 3 facsimile operation. This requires support from the facsimile terminal to implement the recommended T.30/T.32 procedures for document facsimile transmission and recommended T.4 for representing facsimile images.

### Features and Benefits

Sending and receiving Fax services.

### Facsimile Class 2 services

A Service Class 2 Facsimile DCE includes the following services:

1. Connection;
2. Configuration:
  - a. T.30 Procedure Options,
  - b. T.30 Procedure Policy,
  - c. Optional Service Gateways,
  - d. Additional Parameters.
3. Session Status Reporting;
4. Transmit Phase C Data Transfer;
5. Bit reverse Phase C data;
6. Zero-Bit insertion for minimum transmit line time;
7. Copy Quality Checking on Received Data (if reception supported);
8. Other services mandatory in Recommendation T.30;
9. Packet Protocol for DCE-DTE data delivery.

A DTE working with a Service Class 2 facsimile DCE needs to do the following:

1. Preconfigure the DCE, if desired;
2. Initiate sessions: answer or dial;
3. Monitor session status;
4. Transfer Phase C image data, with page separation.

### +FCLASS, Select Mode

The C24 facsimile service maintains a parameter for identification and control of facsimile services, "+FCLASS". When the terminal wants to establish a FAX connection, it must set the

C24 to Service Class 2.0 operation prior to answering or originating a call. This is done by setting AT+FCLASS = 2.0.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+FCLASS=<n>	<b>OK</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the C24 facsimile service class from the available choices.
<b>Read</b>	AT+FCLASS?	<b>+FCLASS: &lt;n&gt;</b> <b>OK</b>	The Read command reads the current service class setting of the C24.
<b>Test</b>	AT+FCLASS=?	<b>+FCLASS: (list of supported &lt;n&gt;s)</b>	The Test command returns <n> values supported by the C24 as a compound value.
<b>Execute</b>	+FCLASS	<b>OK</b>	Restore default value.

The following table shows the +FCLASS parameters.

**Table 3-77: +FCLASS Parameters**

<Parameter>	Description
<n>	0 Data modem (for example, Recommendation V.25 ter) 2.0 Service Class 2.0 FAX.

#### Example

```
AT+FCLASS=?
+FCLASS: 0,2,0
OK
AT+FCLASS?
+FCLASS: 0
OK
AT+FCLASS=2.0
OK
AT+FCLASS=3
+CME ERROR: operation not available
```

#### Service Class 2 FAX action commands

Command	Description
<b>D&lt;dial string&gt;</b>	Dial <dial string> and originate a call.
<b>A</b>	Answer a call.
<b>+FDT</b>	Send a page.

Command	Description
<b>+FDR</b>	Receive a page.
<b>+FKS</b>	Terminate a session, orderly fax abort.
<b>+FIP</b>	Initialize Service Class 2 parameters.

## Service Class 2 FAX Parameters

Parameter	Value (per)	Description	Type
<b>+FAA</b>	EIA/TIA-592	Adaptive-answer parameter (see +FCLASS)	Remote
<b>+FAP</b>	TIA/EIA/IS-134	Addressing and polling capabilities parameter	Remote
<b>+FBO</b>	EIA/TIA-592	Phase-C data-bit-order parameter	Remote
<b>+FBS</b>	EIA/TIA-592	Buffer size parameter (read-only)	Local
<b>+FBU</b>	EIA/TIA-592	HDLC-frame-reporting parameter	Remote
<b>+FCC</b> <b>VR</b> <b>[BR]</b>	EIA/TIA-592 0 1 2 3	DCE-capabilities parameters Vertical-resolution subparameter Bit-rate subparameter • 2400 bits/s • 4800 bits/s • 7200 bits/s • 9600 bits/s	Remote
<b>WD</b>	EIA/TIA-592	Page-width subparameter	
<b>[LN]</b>	EIA/TIA-592	Page-length subparameter	
<b>[DF]</b>	EIA/TIA-592	Data-compression-format subparameter	
<b>[EC]</b>	EIA/TIA-592	Error-correction subparameter	
<b>BF</b>	EIA/TIA-592	Binary-file-transfer subparameter	
<b>ST</b>	EIA/TIA-592	Scan-time-per-line subparameter	
<b>+FCQ</b>	EIA/TIA-592	Copy-quality-checking parameter	Remote
<b>[+FCR]</b>	EIA/TIA-592	Capability-to-receive parameter	Remote
<b>+FCT</b>	EIA/TIA-592	DTE Phase-C timeout parameter	Remote
<b>+FEA</b>	EIA/TIA-592	Phase-C received EOL-alignment parameter	Remote
<b>+FFC</b>	EIA/TIA-592	Format-conversion parameter	Remote
<b>+FHS</b>	EIA/TIA-592	Call-termination-status parameter	Remote
<b>+FIE</b>	EIA/TIA-592	Procedure-interrupt-enable parameter	Remote
<b>+FIS</b>	EIA/TIA-592	Current-session negotiation parameters	Remote
<b>[+FLI]</b>	EIA/TIA-592	Local-ID-string parameter (TSI or CSI)	Remote



Parameter	Value (per)	Description	Type
<b>+FLO</b>	EIA/TIA-592	Flow-control-select parameter	Local
<b>+FLP</b>	EIA/TIA-592	Indicate-document-to-poll parameter	Remote
<b>+FMI</b>	EIA/TIA-592	Request DCE manufacturer identification	Local
<b>+FMM</b>	EIA/TIA-592	Request DCE model	Local
<b>+FMR</b>	EIA/TIA-592	Request DCE revision	Local
<b>[+FMS]</b>	EIA/TIA-592	Minimum-Phase-C-speed parameter	Remote
<b>+FNR</b>	EIA/TIA-592	Negotiation-message-reporting control parameters	Remote
<b>+FNS</b>	EIA/TIA-592	Nonstandard-frame FIF parameter	Remote
<b>+FPA</b>	TIA/EIA/IS-134	Selective Polling Address Parameter	Remote
<b>[+FPI]</b>	EIA/TIA-592	Local-polling-ID-string parameter	Remote
<b>+FPR</b>	EIA/TIA-592	Serial-port-rate-control parameter	Local
<b>[+FPS]</b>	EIA/TIA-592	Page-status parameter	Remote
<b>+FPW</b>	TIA/EIA/IS-134	Password parameter (Sending or Polling)	Remote
<b>[+FRQ]</b>	EIA/TIA-592	Receive-quality-threshold parameters	Remote
<b>+FRY</b>	EIA/TIA-592	ECM-retry-value parameter	Remote
<b>+FSA</b>	TIA/EIA/IS-134	Subaddress Parameter	Remote
<b>[+FSP]</b>	EIA/TIA-592	Request-to-poll parameter	Remote

## Hardware Information

### Hardware Information Commands

#### +GCAP, Request Overall Capabilities

This command indicates the major capability areas of the C24. The support of different areas is presented in the response of the +GCAP command. Each area may be presented by the selection command name of a specific capability area.

Command Type	Syntax	Response/Action
Execute	AT+GCAP	GCAP: <list of supported features><CR><LF> OK // at the end of the list.

#### Example

```
AT+GCAP
+GCAP: +CIS707-A, +MS, +ES, +DS, +FCLASS
OK
```

#### &C, Circuit 109 Behavior

This parameter determines how the state of the DCD line relates to the detection of the received line signal from the distant end. Changing the parameters will take effect immediately in both the command and online command states.

The DCD line is an output line that indicates the following:

- In Circuit mode an active (low) indicates that a valid carrier (data signal) was detected by the C24 (CONNECT message is received), and inactive (high) indicates idle. The AT&C command always puts the DCD command ON, when set to 0. If the AT&C command is set to 1 then the "+++" escape command sets the DCD signal to an inactive state and the ATO command is set to active. The AT&C set to 2 sets the DCD signal OFF.
- In HSPD mode, the DCD line indicates the PPP status. PPP active sets the DCD to active (low); PPP inactive sets the DCD to inactive (high). The DCD is activated only when the PPP is achieved. The DCD is deactivated when the PPP is off

When AT&C is set to 0, the DCD signal is always ON. When AT&C is set to 1, the DCD is activated in online mode. When AT&C is set to 2, the DCD is activated only when the PPP is achieved (temporary IP address is received).

Command Type	Syntax	Response/Action
Set	AT&C<param>	OK In case AT&C is set without value, the default value will be set.

Command Type	Syntax	Response/Action
<b>Read</b>	AT&C?	&C:<param>
<b>Test</b>	AT&C=?	&C:(list of supported <param>s)

The following table shows the &C parameters.

**Table 3-78: &C Parameters**

<Parameter>	Description
<param>	<p>DCD signal ON</p> <p>0 DCD is forced ON at all times.</p> <p>1 DCD is set to ON when:</p> <ul style="list-style-type: none"> <li>a A CD carrier is detected (on-line DATA mode for SCD call).</li> <li>b PPP call (ATD#777) is being established</li> <li>c MIPCALL ODM mode.</li> </ul> <p>DCD is set to OFF when:</p> <ul style="list-style-type: none"> <li>a No CD carrier is detected. This can happen when a CD call has been disconnected or when C24 enters CD online command mode (switch operation).</li> <li>b PPP call was deactivated or when C24 enters pseudo command mode.</li> <li>c When C24 enters pseudo command mode from MIPCALL ODM mode.</li> </ul> <p>2 DCD is forced OFF at all times for CSD and PPP calls.</p> <p>DCD is set to ON when:</p> <p>C24 establishes a MIPCALL connection (IP address is received from the network).</p> <p>DCD is set to OFF when:</p> <p>C24 has lost its MIPCALL connection (IP address is cancelled).</p> <p>The default value is 1.</p>

**Note:** If &C is set to 2 when a CD call is set, DCD will always remain OFF.

The following table shows the &C summary.

**Table 3-79: &C Summary**

&C Settings	0	1	2
<b>CSD call on-line DATA mode</b>	ON	ON	OFF
<b>CSD call pseudo-command mode</b>	ON	OFF	OFF
<b>PPP call (ATD#777)on-line DATA mode</b>	ON	ON	OFF
<b>PPP call pseudo-command mode</b>	ON	OFF	OFF

**Table 3-79: &C Summary (Cont.)**

&C Settings	0	1	2
MIPCALL	ON	OFF	ON
MIPCALL - ODM	ON	ON	ON (already in MIPCALL)

**Example**

```
AT&C?  
&C: 1  
OK  
AT&C0  
OK
```

**&D, Circuit 108 Behavior**

This command determines how the C24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state. The DTR is an input line that indicates that the terminal is ready.

The DTR line must be active (low) in order for the C24 to recognize the terminal. This signal is raised by the terminal when a process activates the serial port. If the DTR is not used by the application, it should connect this line to ground (DTR active). The default value is active (low).

Command Type	Syntax	Response/Action
<b>Set</b>	AT&D<param>	<b>OK</b> In case AT&D is set without value, the default value will be set.
<b>Read</b>	AT&D?	&D:<param>
<b>Test</b>	AT&D=?	&D:(list of supported <param>s)

The following table shows the &D parameters.

**Table 3-80: &D Parameters**

<Parameter>	Description
<param>	<p>The C24's reaction when the DTR status is changed from ON to OFF.</p> <p>In CD calls:</p> <p>0,4 Ignores DTR changes</p> <p>1 Switches the CD call to asynchronous command mode (the call remains connected)</p> <p>2,3 Disconnects the call and returns to the command mode</p> <p>In HSPD calls:</p> <p>0,4 Ignores DTR changes</p> <p>1 Switches the HSPD session to asynchronous command mode (the session remains connected)</p> <p>2,3 Deactivates the HSPD and returns to command mode</p> <p>In MUX and MUX_INIT state:</p> <p>0-3 Ignores DTE changes</p> <p>4 Drops the MUX application and returns to PRE_MUX state</p> <p>The default value is 2.</p>

#### Example

```
AT&D?
&D: 2
OK
AT&D1
OK
```

#### +CBC, Battery Charger Connection

This command enables a user to query the battery power level.

Command Type	Syntax	Response/Action
Read	+CBC	+CBC:<bcs>,<bcl>

The following table shows the +CBC parameters.

**Table 3-81: +CBC Parameters**

<Parameter>	Description
<bcs>	<p>Battery status values</p> <p>0 Battery powered</p> <p>1 Charger detected</p> <p><b>Note:</b> The C24 input power source is connected via the battery pins.</p>
<bcl>	Battery charge level - see <a href="#">Table 3-82</a> .

The following table describes the Battery charge level (<bcl>) parameter.

**Table 3-82: <bcl> Description**

Vcc, V	Remaining Capacity (%)			Battery Charge Level
	TX Mode	Idle Mode	Charging Mode*	
>3.7	> 50%	> 60%	> 90%	90%
3.5-3.7	40% - 50%	45% - 60%	65% - 90%	60%
3.4-3.5	25% - 40%	30% - 45%	45% - 65%	20%
3.35-3.4	15% - 25%	20% - 30%	30% - 45%	10%
3.3-3.35	5% - 15%	5% - 20%	20% - 30%	5%
<3.3	< 5%	< 5%	< 20%	0%

**Note:** The battery level is an average value, which updated once in 0.5 minute max. Each battery level update causes change of one 5 stages sequentially. It means that If the VCC level has changed, for example, from 3.5V to 4.0V, the reports will be as following. All values are on the 70 pin connector. Preciseness is (+/-) 50mV.

#### Example

```
AT+CBC
+CBC: 0,60
OK
AT+CBC
+CBC: 0,20
OK
AT+CBC
+CBC: 1,60
OK
```

//This example shows 0 (battery powered) with 60% power.

//This example shows 0 (battery powered) with 20% power.

//This example shows 1 (charger detected) with 60% charge level.

### +CBAUD, Baud Rate Regulation

This command sets the baud rate on the current UART.

The baud rate of the C24 is changed/set to the request value <rate> written in the command. The specified rate takes effect following the issuing of result code(s) associated with the current command line.

The UART is configured according to the request, or to the specific constant baud rate, or auto baud rate after output "OK" response to the terminal. For example, AT+CBAUD=8 is equivalent to AT+CBAUD=57600.

**Note:** AT&F command sets the C24 to default baud rate - 115200 bps.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CBAUD=<n> AT+CBAUD=<rate>	OK or: ERROR
<b>Read</b>	AT+CBAUD?	+CBAUD: <rate>
<b>Test</b>	AT+CBAUD=?	+CBAUD: (list of supported <n>s, list of supported <rate>s)

The following table shows the +CBAUD parameters.

**Table 3-83: +CBAUD Parameters**

<Parameter>	Description																												
<n> <rate>	<table> <tr> <th>&lt;n&gt;</th><th>&lt;rate&gt;</th></tr> <tr><td>0</td><td>Not in use</td></tr> <tr><td>1</td><td>600</td></tr> <tr><td>2</td><td>1200</td></tr> <tr><td>3</td><td>2400</td></tr> <tr><td>4</td><td>4800</td></tr> <tr><td>5</td><td>9600</td></tr> <tr><td>6</td><td>19200</td></tr> <tr><td>7</td><td>38400</td></tr> <tr><td>8</td><td>57600</td></tr> <tr><td>9</td><td>Not in use</td></tr> <tr><td>10</td><td>115200</td></tr> <tr><td>11</td><td>300</td></tr> <tr><td>12</td><td>230400</td></tr> </table> <p>The default value is 10.</p>	<n>	<rate>	0	Not in use	1	600	2	1200	3	2400	4	4800	5	9600	6	19200	7	38400	8	57600	9	Not in use	10	115200	11	300	12	230400
<n>	<rate>																												
0	Not in use																												
1	600																												
2	1200																												
3	2400																												
4	4800																												
5	9600																												
6	19200																												
7	38400																												
8	57600																												
9	Not in use																												
10	115200																												
11	300																												
12	230400																												

### Example

AT+CBAUD=57600

or

AT+CBAUD=8

//These commands have the same effect

OK

AT+CBAUD?

+CBAUD: 57600

OK

AT+CBAUD=?

+CBAUD: (0-12,300,600,1200,2400,4800,9600,19200,38400,57600,115200,230400)

OK

## +IPR, Local Terminal/C24 Serial Port Rate

This command is responsible for setting and saving the request baud rate per UART.

The baud rate of the C24 is changed/set to the request value <rate> written in the command. The specified rate takes effect following the issuing of result code(s) associated with the current command line.

The UART is configured according to the request, or to the specific constant baud rate, or auto baud rate after output "OK" response to the terminal. For example, AT+IPR=8 is equivalent to AT+IPR=57600.

The <rate> value specified is the rate in bits per second at which the DTE-DCE interface should operate, e.g. "19 200" or "115 200". The rates supported by C24 are manufacturer-specific; however, the IPR parameter should permit the setting of any rate supported by the DCE during online operation.

**Notes:** The value of +IPR is saved and restored by Power Cycle.

AT&F command sets C24 to default baud rate - 115200 bps.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+IPR=<rate>[,<uart>] AT+IPR=<n>[,<uart>]	<b>OK</b> or: <b>ERROR</b> Note: if <uart> parameter is omitted, the <rate> is set for current UART.
<b>Read</b>	AT+IPR?	+IPR: <rate> Note: read format returns <rate> for current UART.
<b>Test</b>	AT+IPR=?	+IPR: (list of supported <n>s, list of supported <rate>s)



The following table shows the +IPR parameters.

**Table 3-84: +IPR Parameters**

<Parameter>	Description	
<n> <rate>	<n>	<rate>
	0	Not in use
	1	600
	2	1200
	3	2400
	4	4800
	5	9600
	6	19200
	7	38400
	8	57600
	9	Not in use
	10	115200
	11	300
	12	230400 (allowable only for UART1)
	The default value is 10.	
<uart>	1	UART1
	2	UART2

#### Example

```

AT+IPR=6
OK
AT+IPR?
+IPR: 19200
OK
AT+IPR=?
+IPR: (0-12,300,600,1200,2400,4800,9600,19200,38400,57600,115200,230400)
OK

```

#### &K, RTS/CTS Flow Control

This command configures the flow control. The RTS (Request To Send) is an input line. The RTS signal is received from the terminal and a low condition indicates that the C24 can send more data. The CTS (Clear To Send) is an output line. The CTS signal is sent to the terminal and a low state indicates that more data can be sent to the C24.

The RTS and CTS together make up what is called RTS/CTS or "hardware" flow control. Both lines are used when "hardware flow control" is enabled in both the terminal and the C24 devices. When the terminal is ready and able to receive data, it puts the RTS line in an active (low) condition to indicate this to the C24. If the terminal is not able to receive data (typically because its receive buffer is almost full), it puts the RTS line in an inactive (high) condition as a signal to the C24 to stop sending data. When the terminal is ready to receive more data (for example, after data has been removed from its receive buffer), it places this line back in the active condition. The RTS line complements the CTS line. The C24 puts the CTS line in an active condition to tell the terminal that it is ready to receive the data. Likewise, if the C24 is unable to receive data, it places

the CTS line in an inactive condition.

Command Type	Syntax	Response/Action
<b>Set</b>	<b>AT&amp;K&lt;param&gt;</b>	<b>OK</b> In case AT&K is set without value, the default value will be set.
<b>Read</b>	<b>AT&amp;K?</b>	<b>&amp;K: &lt;param&gt;</b>
<b>Test</b>	<b>AT&amp;K=?</b>	<b>&amp;K: (list of supported &lt;param&gt;s)</b>

The following table shows the &K parameters.

**Table 3-85: &K Parameters**

<Parameter>	Description
<param>	0    Disable all terminal/C24 flow control 3    Enable CTS/RTS terminal/C24 flow control 4    Enable Xon/Xoff terminal/C24 flow control 5    Enable Xon/Xoff terminal/C24 flow control 6    Enable CTS/RTS terminal/C24 flow control The default value is 3.

**Example**

```
AT&K?  
&K: 3  
OK  
AT&K4  
OK
```

## +CFUN, Shut Down Phone Functionality

This command shuts down the phone functionality of smart phones and PDAs with phone capabilities in order to prevent interference from a nearby environment. This enables other functionality to continue to be used in environments where phone use is either impractical or not permitted. For example, on airplanes the use of cellular phones is forbidden during the entire flight, but the use of computers is allowed during much of the flight. This command enables other functionality to continue while preventing use of phone functionality.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+CFUN=[&lt;fun&gt; [&lt;rst&gt;]]</b>	<b>OK</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command selects the level of functionality <fun> in the smart phone or PDA incorporating the C24.
<b>Read</b>	<b>AT+CFUN?</b>	<b>+CFUN: &lt;fun&gt;</b> <b>OK</b>	The Read command displays the current level of functionality.
<b>Test</b>	<b>AT+CFUN=?</b>	<b>+CFUN: (list of supported &lt;fun&gt;s), (list of supported &lt;rst&gt;s)</b> <b>OK</b>	The Test command displays the list of supported functionality settings.

The following table shows the AT+CFUN parameters.

**Table 3-86: +CFUN Parameters**

<Parameter>	Description
<b>&lt;fun&gt;</b>	Functionality levels: 0 Full functionality (default 0) 1 Full functionality 4 Disables phone transmit & receive RF circuits
<b>&lt;rst&gt;</b>	0 Sets functionality to <fun> without resetting the device (default) 1 Resets the device before setting functionality to <fun>

### Examples

AT+CFUN=?

+CFUN: (0, 1, 4), (0-1)

OK

AT+CFUN?

+CFUN: 0

OK

AT+CFUN=4

//Disable phone transmit and receive RF circuits

Ok

AT+CFUN?  
+CFUN: 4

Power cycling...

AT+CFUN?  
+CFUN: 4

Power cut ...

AT+CFUN? // Phone transmit and receive RF circuits (default value of first parameter after power cut is '0')  
+CFUN: 0

AT+CFUN=1 // Enable phone transmit and receive RF circuits through '1'  
OK

AT+CFUN?  
+CFUN: 1

Power cycling...

AT+CFUN?  
+CFUN: 1

Power cut ...

AT+CFUN?  
+CFUN: 0  
OK

## ATS97, Antenna Diagnostic

This command indicates whether an antenna is physically connected to the C24 RF connector. This information is also provided by a dedicated hardware signal, which is outputted on pin 41 (ANT\_DET) of the interface connector.

**Note:** This command doesn't indicate the actual Network or Antenna status & Module operation should not be based on the antenna detection status in any case.

Command Type	Syntax	Response/Action	Remarks
Execute	ATS97	OK or: +CME ERROR: <err>	
Read	ATS97?	<info> OK or: +CME ERROR: <err>	The Read command indicates whether the antenna is connected.

The following table shows the ATS97 parameters.

**Table 3-87: ATS97 Parameters**

<Parameter>	Description
<info>	000 The antenna is not connected
	001 The antenna is connected

### Example

```
// Connect the antenna
ATS97?
001
ATS97
OK
ATS97=?
ERROR
// Disconnect the antenna
ATS97?
000
```

### +MRST, Perform Hard Reset

The +MRST command enables customer software to perform a hard reset to the C24 unit. This command provides a software simulation for pressing the power-off button. The command can be sent to the C24 unit from each of the MUX channels.

Command Type	Syntax	Response/Action	Remarks
Execute	+MRST	OK	The Set command performs a graceful hard reset to the C24 module.

### Example

```
AT+MRST
OK
// Result - C24 module performs a power down
```

### +MIOC, Motorola I/O Configure

This command defines the C24 8 GPIO pins data value. The feature is flex enabled or disabled. This command is a basic command.

The feature is active by default, however, changing the FLEX can eliminate it.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MIOC=<Pin selection>,<Data vector>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The set command defines the logic value of selected pins to high or low when pin is configured as output. The C24 saves the new setting in flex. Only selected pins are affected. Set action is allowed only for pins configured as output. In case <Data vector> includes values of input pins, those values will be ignored. In case <pin selection> includes input pins, an error will be issued "Operation not allowed". No action will take place.
<b>Read</b>	+ MIOC?	<b>+MIOC: &lt;Data vector&gt;</b>  <b>OK</b>	The read command returns the actual logical value of the 8 GPIO pins.
<b>Test</b>	+ MIOC=?	<b>+MIOC: (list of supported &lt;Pin selection&gt;s),(list of supported &lt;Data vector&gt;s)</b>  <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The test command returns the possible ranges of <Pin selection>s and <Data vector>s.

The following table shows the +MIOC parameters.

**Table 3-88: +MIOC Parameters**

<Parameter>	Description
<b>&lt;pin selection&gt;</b>	Selected pins for the action invoked. This is a binary vector in which each bit points to pin number. Vector size is 8. 0 Not selected 1 Selected pin (default)
<b>&lt;data vector&gt;</b>	This is a binary vector in which each bit show the physical value of pin. Data vector size is 8. 0 Physical low signal. 1 Physical high signal (default). <b>The default value:</b> On Power Up - as previously saved in FLEX bytes. Before set command first used with <Data vector> and <Mode>=0, or after +MIOC without <Data vector> and before +MIOC command used - 1.

**Example**

```
AT+MIOC=?
+MIOC: (00000000-11111111),(00000000-11111111)
OK
```

**Light control example:**

Client has an electronic controlled light switch. The intent is to connect this switch to the C24 (IO pin 5 - for example) and control the light by setting the logical values of pin 5.

Example of code is as follows:

```
AT+MIOD=00010000,0           // Set IO pin #5 to be output.
OK
AT+MIOD?                     // (Optional) Read the IO pin definitions to confirm correct settings.
+MIOD: 11101111// Pins 1-4 and 6-8 are input pins. Pin 5 is output.
OK                           // At this point the module is configured to control the logic values of
                             // pin 5.
AT+MIOC=00010000, 00010000 // Turn on the light by setting pin 5 to high.
AT+MIOC?                     // (Optional) read the pins status.
+MIOC: 00010000// Pin 5 is set to high.
OK
AT+MIOD=00010000,0, 00010000 // All previous defined in one command.
OK
AT+MIOC=00010000,00000000    // Turn off the light by setting pin 5 to low.
OK
AT+MIOC?// (Optional) read the pins status.
+MIOC: 00000000             // Pin 5 is set to low.
OK
```

**Data sending (vector example):**

Client has a data bus with 8 bits and plans to implement some protocol over it. In this example 4 pins (pins 1-4) are used as an output and 4 pins (5-8) are used as input.

Example of code is as follows:

```
AT+MIOD=00001111,0           // Set IO pins 1-4 to be output level mode.
OK
AT+MIOD=11110000,1           // Set IO pins 5-8 to be input level mode.
OK // Unnecessary, because by default all pins are input.
AT+MIOD?                     // (Optional) Read the IO pin definitions to confirm correct settings.
+MIOD: 11110000// Pins 1-4 output pins 5-8 input.
OK                           // At this point the module is configured to control the logic values of
                             // all pins.
AT+MIOC=00001111,00000011// Write vector, 0x3 on pins 1-4.
OK                           // (pins 1,2 high, pins 3,4 low).
AT+MIOC?// Read the pins status.
+MIOC: 01000011             // Pins 1,2,7 show the logical value high.
OK
AT+MIOC=00001111,00000000    // Write vector 0x0 on pins 1-4.
OK
AT+MIOC?                     // (Optional) read the pins status.
+MIOC: 01110000             // Pin 1-4 low, pins 5,6,7 show logical high.
OK
```

## +MIOD, Motorola I/O Define

This command defines the C24 8 GPIO pins configuration. The feature is flex enabled or disabled.

This command is a basic command.

The feature is active by default, however, changing the FLEX can eliminate it.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+MIOD=&lt;Pin selection&gt;,&lt;Mode&gt; [,&lt;Data vector&gt;]</b>	<b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The set command defines the behavior mode of each selected IO pin. The C24 saves the new setting in flex. The selected pins are affected. Validity check of all parameters will be done and appropriate standard error will be issued. In case of legal parameters the new configuration is set. If <Data vector> doesn't supply and new <Mode> is output a line will care physical high signal. In case <Data vector> is supply and includes values of input pins, those values will be ignored. In case <Mode> is input and <Data vector> is supply, an error will be issued "Operation not allowed". No action will be done.
<b>Read</b>	<b>+ MIOD?</b>	<b>+MIOD: &lt;Mode vector&gt;</b> <b>OK</b>	The read command returns the current behavior mode of the 8 GPIO pins.
<b>Test</b>	<b>+ MIOD=?</b>	<b>+MIOD: (list of supported &lt;Pin selection&gt;s),(list of supported &lt;Mode&gt;s),(list of supported &lt;Data vector&gt;s)</b> <b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The test command returns the possible ranges of <Pin selection>s, <Mode>s and <Data vector>s.

The following table shows the +MIOD parameters.

**Table 3-89: +MIOD Parameters**

<Parameter>	Description
<b>&lt;pin selection&gt;</b>	Selected pins for the action invoked. This is a binary vector in which each bit points to pin number. Vector size is 8. 0 Not selected 1 Selected pin (default)
<b>&lt;mode&gt;</b>	GPIO pin operation mode. 0 Output (level only) 1 Input (level mode)



**Table 3-89: +MIOD Parameters (Cont.)**

<Parameter>	Description
<mode vector>	<p>This is a binary vector in which each bit shows the operation mode of pin. Data vector size is 8.</p> <p>0      Output (level only)</p> <p>1      Input (level mode)</p> <p><b>The default value:</b> On Power Up - as previously saved in FLEX bytes. Before set command first used - 1. (This means that all lines are configured as Input before set command first used).</p>
<data vector>	<p>This is a binary vector in which each bit shows the physical value of pin. Data vector size is 8.</p> <p>0      Physical low signal.</p> <p>1      Physical high signal (default).</p> <p><b>The default value:</b> On Power Up - as previously saved in FLEX bytes. Before set command first used with &lt;Data vector&gt; and &lt;Mode&gt;=0, or after +MIOD without &lt;Data vector&gt; and before +MIOD command used - 1.</p>

The following table shows the keypad GPIOs.

**Table 3-90: Keypad GPIOs**

GPIO Name	70 PIN connector, PIN#	GPIO Number
GPIO1	28	1
GPIO2	30	2
GPIO3	32	3
GPIO4	34	4
GPIO5	36	5
GPIO6	38	6
GPIO7	40	7
GPIO8	42	8

**Example**

```

+MIOD: (00000000-11111111),(0,1),( 00000000-11111111)
AT+MIOD=00010000,0           // Set IO pin #5 to be output.
OK
AT+MIOD?
+MIOD: 11101111              // Pins 1-4 and 6-8 are input. Pin 5 is output.
OK
AT+MIOD=00001111,0           // Set IO pins 1-4 to be output level mode.
OK
AT+MIOD=11110000,1           // Set IO pins 5-8 to be input level mode.(Default settings).
OK

```

```
AT+MIOD?  
+MIOD: 11110000          // Pins 1-4 output pins, 5-8 input pins.  
OK
```

### +MMAD, Query and Monitor ADC Value

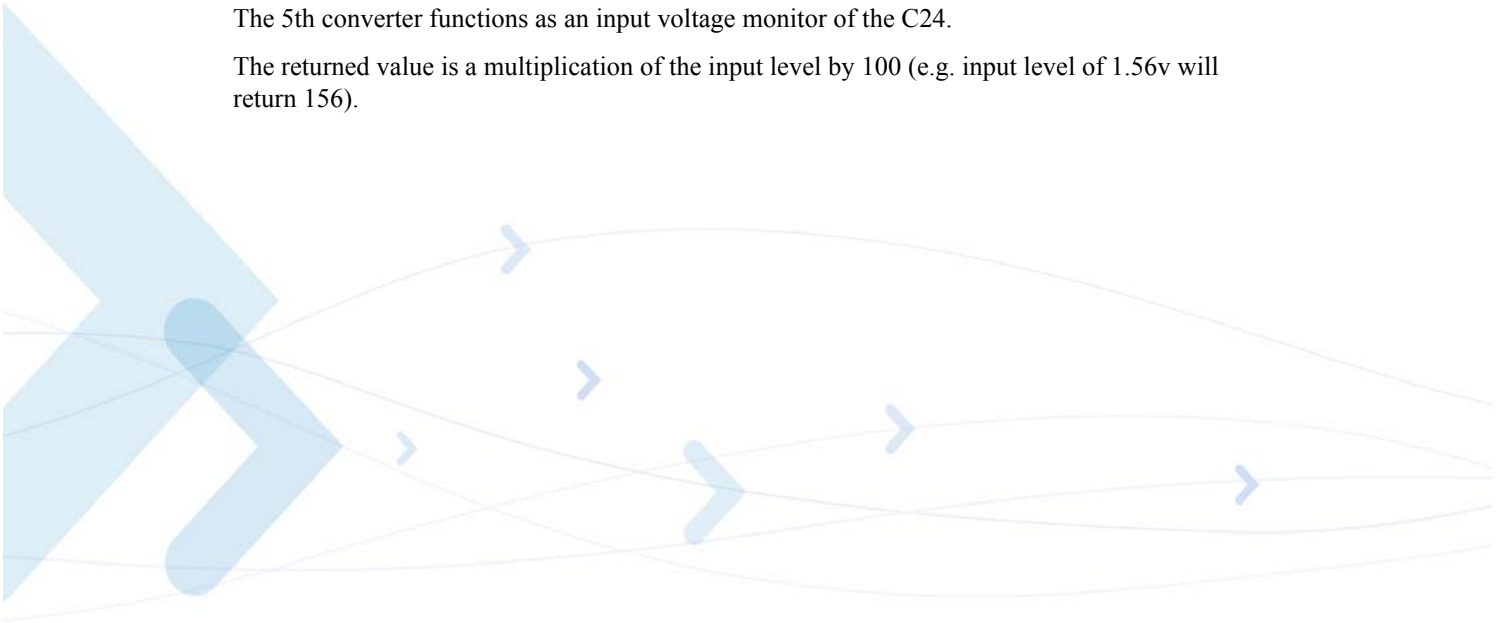
This command intends to query and monitor ADC value.

This command returns the current ADC values for the requested channel. The values received from the first 3 converters represent the DC voltage levels of the input to pins 37, 43 and 47 on the 70 pin connector.

The returned value is a multiplication of the input level by 100 (e.g. input level of 1.56V will return 156).

The 5th converter functions as an input voltage monitor of the C24.

The returned value is a multiplication of the input level by 100 (e.g. input level of 1.56v will return 156).



## Unsolicited Event Syntax

+MMAD:<Converter Number>,<Converted Value>

Command Type	Syntax	Response/Action	Remarks
Set	<p>AT+MMAD=&lt;Converter number&gt;[, [&lt;Report&gt;],[&lt;Rate&gt;],[ &lt;Low&gt;],[&lt;High&gt;],[&lt;Num_of_Samples&gt;, [&lt;Average_Calc_Duration&gt;], [&lt;Report_Interval&gt;]]]</p> <p>AT+MMAD= &lt;Converter_number&gt;</p>	<p>+MMAD:&lt;Converter Number&gt;,&lt;Average&gt; OK or: +CME ERROR: &lt;err&gt;</p> <p>+MMAD:&lt;Converter Number&gt;,&lt;Converted Value&gt; OK or:</p> <p>+MMAD: &lt;Converter_number&gt;, &lt;Average&gt; OK</p>	<p>If average is active on that converter, the response value shall be the latest average calculated.</p> <p>If average is not active on that converter, the response value shall be the converted value.</p> <p>If average is active on that converter, and report interval not selected, the response value shall be the latest average calculated (solicited message).</p>
Read	AT+MMAD?	<p>+MMAD: &lt;Converter number&gt;, &lt;Report&gt;,&lt;Rate&gt;,&lt;Low&gt;,&lt;High&gt;&lt;Num_of_samples&gt; &lt;Average_calc_duration&gt;&lt;Report_interval&gt;&lt;CR&gt;&lt;LF&gt; &lt;Converter number&gt;, &lt;Report&gt;,&lt;Rate&gt;,&lt;Low&gt;,&lt;High&gt;&lt;Num_of_samples&gt; &lt;Average_calc_duration&gt;&lt;Report_interval&gt; &lt;CR&gt;&lt;LF&gt; &lt;Converter number&gt;, &lt;Report&gt;,&lt;Rate&gt;,&lt;Low&gt;,&lt;High&gt;&lt;Num_of_samples&gt; &lt;Average_calc_duration&gt;&lt;Report_interval&gt; &lt;CR&gt;&lt;LF&gt; &lt;Converter number&gt;, &lt;Report&gt;,&lt;Rate&gt;,&lt;Low&gt;,&lt;High&gt;&lt;Num_of_samples&gt; &lt;Average_calc_duration&gt;&lt;Report_interval&gt; &gt;&lt;CR&gt;&lt;LF&gt; &lt;Converter number&gt;, &lt;Report&gt;,&lt;Rate&gt;,&lt;Low&gt;,&lt;High&gt;&lt;Num_of_samples&gt; &lt;Average_calc_duration&gt;&lt;Report_interval&gt; OK</p>	

Command Type	Syntax	Response/Action	Remarks
Test	AT+MMAD=?	+MMAD:(range of <Converter Number>'s),(range of <Report>'s),(range of <Rate>'s),(range of <Low>'s), (range of <High>'s), (range of <Converted Value>'s), (range of <Num_Of_Samples>'s), (range of <Average_Calc_Duration>'s), (range of <Report_Interval>'s) OK	
Unsolicited Messages	AT+MMAD=<Converter_number>  Case: *. Average calculation isn't active :  *. Average calculation is active:	+MMAD: <Converter_number>, <Converted_Value> OK   +MMAD: <Converter_number>, <Average> OK	If <Report> value is - 3, the report will be generated according to report interval value. If <Report interval> value did not set, there will be no messages but you can ask for solicited message.

**Note:** If the average calculation is not ready, it's because:  
[(number of samples \* rate) > report interval] and the response will be - 0.

The following table shows the +MMAD parameters.

**Table 3-91: +MMAD Parameters**

<Parameter>	Description
<Converter Number>	1-5 Select the A2D converter.
<Report>	0 Unsolicited report is not active/ stop unsolicited report (default). 1 Unsolicited report in active for all A2D conversion events. 2 Unsolicited report is active only for out off boundaries events. 3 "Average report" - send periodic average.
<Rate>	1-255 Select the time interval between two samples. Units: 100 milliseconds - in case of average computation, Seconds - in case of A/D sampling only.
<low>,<High>	0-450 A decimal value represents the digital value.  Low - The lowest boundary level of digital value. High - The Highest boundary level of digital value. Default value for converters 1-3 is 0-250. Default value for converter 5 is 300-450.
<Converted Value>	A decimal value represents the returned digital value. For converters 1-3 and 5 the returned value represent the input level multiplied by 100.

**Table 3-91: +MMAD Parameters (Cont.)**

<Parameter>	Description
<Num_of_samples>	The number of samples that are used for average calculation.
<Average_calc_duration>	For how long the average calculation will be active. 0 - Not active. 255 - Endless. 1...254 - minutes.
<Report_interval>	Time interval between two average reports (seconds).
<Average>	Average calculation result. Units: same as <Converted_Value>.

**Example**

```

AT+MMAD=1 // Read A2D1 values with analog input of 1.75V.
+MMAD:1,175
OK

AT+MMAD=2,1,15 // Read A2D2 converted value every 15 seconds and send unsolicited
report to the DTE.
OK
+MMAD:2,10 // Unsolicited Report after 15 seconds.
+MMAD:2,12 // Unsolicited Report after 30 seconds.
AT+MMAD=3,2,1,25,100
OK // Read A2D3 converted value every 1 second and send
unsolicited report if the converted value is out of boundaries.
+MMAD:3,102 // Unsolicited report of value out of boundaries.

AT+MMAD? // Read monitoring setup values of all A2D's
+MMAD:1,0,10,0,250
+MMAD:2,1,15,0,250
+MMAD:3,2,1,25,100
+MMAD:5,0,1,300,450
OK

// Activate Average calculation + report originated by C24
// Converter num=1, report=3, rate=5*100mili, low,high, 16 samples
AT+MMAD=1,3,5,,16
OK
AT+MMAD=1
OK
+MMAD:1,175 // 175= The average A/D value

// Activate Average calculation periodically every 30 sec, during 5 minutes, rate=5.
// report originated by C24
// Converter num=1, report=3, rate=5*100ms, low,high, N_samples, duration=5
AT+MMAD=1,3,5,,16,5,30
OK
+MMAD:1,175 //First report
+MMAD:1,140 //Second report

```

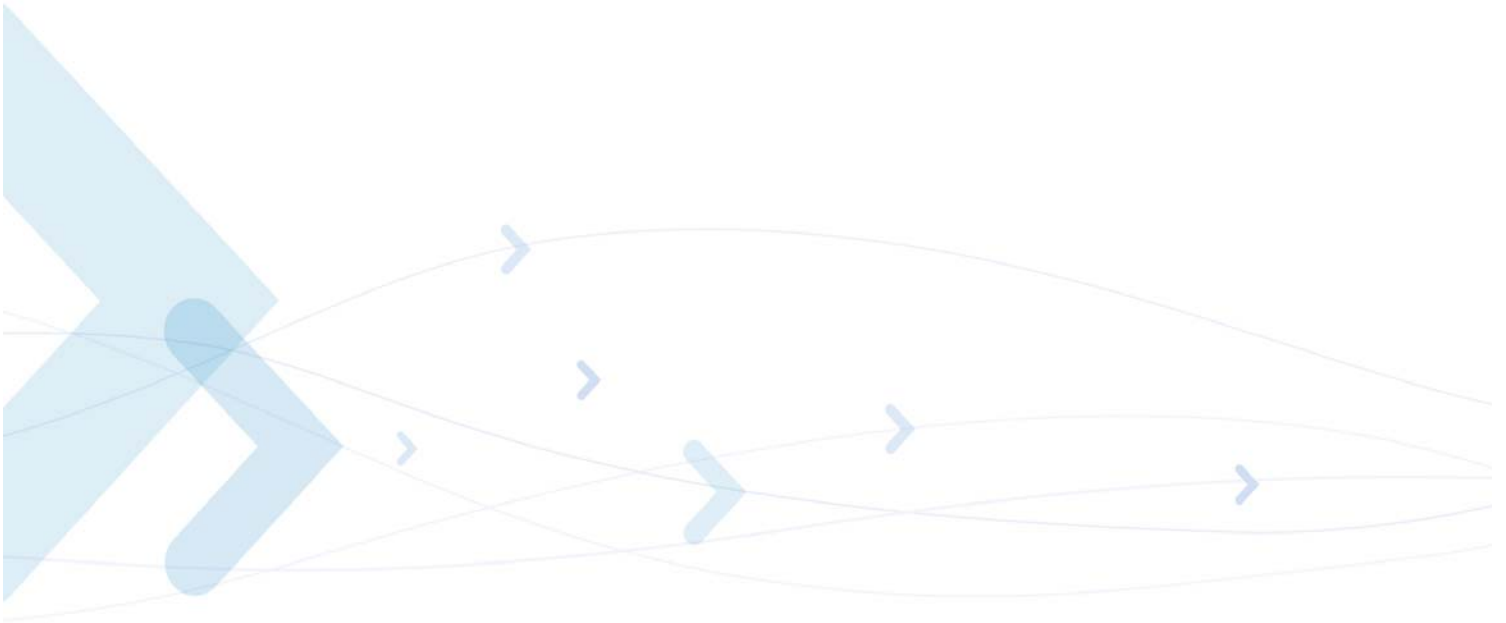
.....

+MMAD:1,160 //Last Avr report

AT+MMAD=? //Test command - range of all setup parameters and

+MMAD: (1-3,5),(0-3),(1-255),(0-450),(0-450),(2-255),(1-255),(0-255)

OK



## TCP/IP

### +MIPCALL, Create a Wireless Link

This command sets up a PPP (Point to Point Protocol) connection with the carrier, and returns a valid IP for the C24.

**Note:** The DCD line changes only to reflect the state change from command mode to data mode.

Command Type	Syntax	Response/Action
<b>Set</b>	<b>+MIPCALL= &lt;Operation&gt;[ , &lt;User name&gt;, &lt;Password&gt;]</b>	<b>OK</b> <b>+MIPCALL: &lt;IP address&gt;</b> <b>or:</b> <b>ERROR: &lt;err&gt;</b> <b>+MIPCALL: 0</b>
<b>Read</b>	<b>+MIPCALL?</b>	<b>+MIPCALL: &lt;status&gt;[,&lt;IP&gt;]</b>
<b>Test</b>	<b>+MIPCALL=?</b>	<b>+MIPCALL: (list of supported &lt;operation&gt;s)</b>

**Note:** The +MIPCALL command does not return the prompt to the terminal until the IP is received from the provider, this process should happen within 40sec, or time out has occurred, which should take around 9 sec, therefore, no other commands can be issued in the meantime.

The +MIPCALL command does not have a general ABORT mechanism, therefore a command cannot be issued until the previous command ends.

When a call exists the IP address will be returned.

For example:

**AT+MIPCALL?**

**+MIPCALL: 1,172.17.237.80**

In case of dormant mode and the timer expired and the module will lose his connection, an unsolicited report of no wireless link should be displayed in the terminal (+MIPCALL: 0).

The following table shows the +MIPCALL parameters.

**Table 3-92: +MIPCALL Parameters**

<Parameter>	Description
<b>&lt;Operation&gt;</b>	0     Disconnect 1     Connected
<b>&lt;status&gt;</b>	0     Disconnected 1     Connected
<b>"User name"</b>	If SIP is used, then the specified user name and password is used A MIP data call does not require a userID or password.

**Table 3-92: +MIPCALL Parameters (Cont.)**

<Parameter>	Description
<b>"Password"</b>	If SIP is used, then the specified user name and password is used A MIP data call does not require a userID or password.
<b>IP-address</b>	IP address given by server after PPP negotiation.

**Example**

```

AT+MIPCALL=1,"User1","Pswd" //Connecting the provider and getting an IP
+MIPCALL: 123.145.167.230
AT+MIPCALL=0                //The terminal hangs up the link
OK

```

**+MIOPEN, Open a Socket (UDP or TCP)**

This command causes the C24 module to initialize a new socket that waits for a connection from a remote machine or opens a common or TCP secured with SSL connection with a remote side (according to received parameters). Each socket allocates an accumulating buffer whose size is 1372 bytes.

**Note:** The +MIOPEN command returns a +MIPSTAT unsolicited event if it fails, for example, if it was rejected by the remote side.

The +MIOPEN command returns a +MIPSSL unsolicited event(s) in case of alert(s) occurring during secure connection.

SSL connection is not supported for listening sockets.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MIOPEN= <Socket ID>, <Source Port>, <Remote IP>, <Remote Port>, <Protocol>	<b>OK</b> or: +MIOPEN: <Socket ID>,<State>[,<Remote IP>,<Remote Port>] or: +MIPSTAT: <Socket ID>,<Status> or: <b>ERROR: &lt;err&gt;</b>	The Set command returns <Remote IP> and <Remote Port> parameters only for sockets opened in Listen mode.
<b>Read</b>	AT+MIOPEN?	+MIOPEN:[<SocketID>] for each socket that can be opened or: +MIOPEN 0 if there are no free sockets.	The Read command returns the numbers of the sockets that can be opened.
<b>Test</b>	AT+MIOPEN=?	+MIOPEN: (list of supported <socket ID>s),(list of supported <source port>s),(list of supported <"Destination IP">s), (list of <destination port>s),(list of supported <protocol>s)	



The following table shows the +MIOPEN parameters.

**Table 3-93: +MIOPEN Parameters**

<Parameter>	Description
<b>Socket ID</b>	A unique number that identifies a connection (provided by the terminal application). 0 Invalid socket number. 1,2,3,4 Valid socket numbers.
<b>Source Port</b>	Port of source site. Port range: 1-65535 (decimal digits)
<b>Remote IP</b>	<b>IP:</b> IP of the remote site in the format "AAA.BBB.CCC.DDD". The range of each octet is 0-255. Value can be written in 1, 2, or 3 digits. <b>Host name:</b> Host-name of destination site. The host-name do not validate, except the maximum length (255 characters), the host-name convention should meet the rules as describe in RFC-1035 section: 2.3. Conventions.
<b>Remote Port</b>	Port of remote site. Port range: 1-65535 (decimal digits). Port 0 for incoming connection.
<b>Protocol</b>	Type of protocol stack. 0 TCP 1 UDP 2 TCP secured with SSL
<b>State</b>	State of socket or error indication. 0 Inactive 1 Active 2 SSL secured

**Note:** Motorola does not recommend using port numbers below 1024. These numbers are defined to be reserved for operating systems.

### Example

AT+MIOPEN=1,1200,"123.245.213.012",1234,0//Opening socket 1, using TCP protocol, from port 1200, targeting 123.245.213.012 port 1234

+MIOPEN=2,1300,"123.133.074.192",1242,1//Opening socket 2, using UDP protocol, from port 1300, targeting 123.133.074.192 port 1242

AT+MIOPEN=1,1222,"123.245.213.012",1234,0//Opening socket 1, using TCP protocol, from port 1222, targeting 123.245.213.012 port 1234

AT+MIOPEN: //Invalid command

ERROR

AT+MIOPEN? //Terminal checking the free sockets

+MIOPEN: 3 4

OK

AT+MIOPEN=1,0,"WWW.GOOGLE.COM",80,0//TCP

OK

+MIOPEN: 1,1

AT+MIOPEN=1,0,"www.google.com",80,0//TCP

OK

+MIOPEN: 1,1

AT+MIOPEN=2,0,"www.google.com",80,1//UDP

```

OK
+MIOPEN: 2,1
// Listen socket over TCP:
AT+MIOPEN=1,1100,"0.0.0.0",0,0 // Listens to any port at any IP.
OK
+MIOPEN: 1,1,122.221.32.64,1200// Remote side connected to the listen socket.
AT+MIOPEN=3,3212,"122.1.222.134",0,0 // Listen to any port at specific IP.
OK
+MIOPEN: 3,1,122.1.222.134,1222// Remote side connected to the listen socket.
//SSL
AT+MIOPEN=2,2222,"www.google.com",443,2 // TCP secured with SSL
OK
+MIOPEN: 2,2
AT+MIOPEN=3,1234,"www.xyz.com",443,2 // TCP secured with SSL
OK
+MIPSSL: 3,15 // SSL_UNKNOWN_CA alert
+MIOPEN: 3,2

```

## +MIPCLOSE, Close a Socket

This command causes the C24 to free the socket accumulating buffer and to close the socket.

**Note:** All data stored in the accumulating buffer before the MIPCLOSE command will be sent. Refer to “+MIPSETS, Set Size and Timeout for Automatic Push” on page 3-157 and “+MIPPUSH, Push Data into Protocol Stack” on page 3-160.

Command Type	Syntax	Response/Action
Set	+MIPCLOSE = <Socket ID>	OK +MIPCLOSE: <Socket ID>[,<number_of_acknowledged_bytes >],<close_type> or: ERROR
Read	+MIPCLOSE?	+MIPCLOSE: [<socket ID>]  OK (for all ACTIVE sockets) OR: +MIPCLOSE: 0  OK (if no active sockets)
Test	+MIPCLOSE=?	+MIPCLOSE: (1-4)  OK

The following table shows the +MIPCLOSE parameters.

**Table 3-94: +MIPCLOSE Parameters**

<Parameter>	Description
<Socket_ID>	A unique number that identifies a connection. Valid socket numbers - 1, 2, 3 and 4
<number_of_acknowledged_bytes >	Total number of bytes that were acknowledged.
<close_type>	Connection close type: 0 - Connection was closed correctly. 1 - The remote side didn't reply, so connection closed by close timeout. 2 - Other (The remote side replied with RST, retransmission timeout occurred, etc.).

### Example

```

AT+MIPCLOSE=1           //The terminal closes the opened socket
OK
+MIPCLOSE: 1,0          // Socket 1 closed. The remote side replies with FIN.
AT+MIPCLOSE=1           //The terminal closes the opened socket
OK
+MIPCLOSE: 1,1          //Socket 1 closed. The remote side did not reply, so +MIPCLOSE
                        //indication received after close timeout.
AT+MIPCLOSE=3           //The terminal closes the opened socket
OK
+MIPCLOSE: 3,1024,2     //Socket 3 closed. Ack indication enabled - 1024 bytes were acked.
The remote side did reply with RST.
AT+MIPCLOSE=2           //The terminal closes the socket that wasn't opened
ERROR
AT+MIPCLOSE?            //Sockets 1 and 2 are opened
+MIPCLOSE: 1,2
OK
AT+MIPCLOSE?            //No opened sockets
+MIPCLOSE: 0
OK

```

## +MIPSETS, Set Size and Timeout for Automatic Push

This command causes the C24 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.

Data chunks between the terminal and the C24 are limited to be smaller than 80 characters (160 characters in coded form). In order to reduce the overhead of sending small amounts of data over the air, the C24 uses an accumulating buffer. The terminal can specify a watermark within the accumulating buffer size limits to indicate how much data should be accumulated. When the data

in the accumulating buffer exceeds the watermark, only data equal to the watermark is sent. Data remaining in the buffer is sent with the next packet.

**Note:** If there is data in the accumulating buffer, the +MIPSETS command will be rejected.

Command Type	Syntax	Response/Action
<b>Set</b>	+MIPSETS= <Socket ID>,<Size>	<b>OK</b> or: <b>ERROR</b> +MIPSETS: <err>
<b>Read</b>	+MIPSETS?	+MIPSETS: [<SocketID>,<Current Size Settings>] For all ACTIVE sockets.
<b>Test</b>	+MIPSETS=?	+MIPSETS: (1-4),(list of supported <size>s)

The following table shows the +MIPSETS parameters.

**Table 3-95: +MIPSETS Parameters**

<Parameter>	Description
<b>Size</b>	Size of the buffer 1 < size ≤ 1372 The default value is 1372.
<b>Extended err</b>	3 Operation not allowed

### Example

```

AT+MIPSETS=1,340           //Asks the C24 to accumulate 340 bytes on socket 1 prior to sending
                             (socket should be activated by the +mipopen command)

+MIPSETS: 0
OK
AT+MIPSETS=1,200           //Asks the C24 to accumulate 200 bytes on socket 1 prior to sending
                             (socket should be activated by the +mipopen command)

+MIPSETS: 0
OK
AT+MIPSETS=2,400           //Asks the C24 to accumulate 400 bytes on socket 2 prior to sending

+MIPSETS: 0
OK
AT+MIPSETS=?
+MIPSETS: (1-4),(1-1372)
OK
AT+MIPSETS?
+MIPSETS: 1,100           //Information provided only for active sockets
+MIPSETS: 2,1372          //Information provided only for active sockets
OK

```

## +MIPSEND, Send Data

This command causes the C24 to store the data that the terminal provides in the accumulating buffer, and then send this data using an existing protocol stack when the amount of data reaches the predefined amount (see “+MIPSETS, Set Size and Timeout for Automatic Push” on [page 3-157](#)). Before sending data, a valid connection must be created using the +MIPCALL and +MIPOPEN commands.

Motorola recommends that the terminal sets the watermark in the accumulating buffer prior to this command, using the +MIPSETS command. By default, the watermark is set to 1372 bytes of data.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MIPSEND = <Socket ID>,<Data>	<b>ERROR</b> +MIPSEND: <Socket ID>,<Status>,<Free Size>	Data in the +MIPSEND command is limited to 80 characters (160 in coded form). <Status>: 0 - Success 1 - Socket is flowed off
<b>Read</b>	+MIPSEND?	+MIPSEND <Socket ID>,<Free Size>>[<Socket ID> <Free Size>]<CR><LF> For all ACTIVE sockets.	
<b>Test</b>	+MIPSEND=?	<b>ERROR</b>	

The following table shows the +MIPSEND parameters.

**Table 3-96: +MIPSEND Parameters**

<Parameter>	Description
<socket ID>	1,2,3,4    Number of valid socket
<Free Size>	Free space in current buffer. Free size is calculated from the 1372. 0       < Free Size < 1372
<Data>	User data string is sent encoded with 0-F hexadecimal digits (String ends with a <CR>)

**Note:** The free size is calculated from the buffer size (1372 byte) no matter if watermark was set.

AT+MIPSETS=1,4

AT+MIPSEND=1,"1234"

+MIPSEND: 1,1370

AT+MIPSEND=1,"123456"

+MIPSEND: 1,1371

### Example

(Socket 4 was not opened using +MIPOPEN AT command)

AT+MIPSEND=4,"4444"

ERROR

AT+MIPSEND=1,"4444"

+MIPSEND: 1,1370 //1372- 2 chars 'DD' = 1370

OK

AT+MIPSEND=?

ERROR

AT+MIPSEND?

+MIPSEND: 1,1372 //Sockets 1 and 2 were opened using + MIPOPEN AT command

+MIPSEND: 2,1372 //Sockets 1 and 2 were opened using + MIPOPEN AT command

OK

## +MIPPUSH, Push Data into Protocol Stack

This command causes the C24 to push the data accumulated in its accumulating buffers into the protocol stack. It is assumed that before using this command, some data should exist due to previous +MIPSEND commands.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MIPPUSH = <Socket ID>[,<"Destination IP">,<Destination Port>]	+MIPPUSH: <Socket_ID>,<Status>[ ,<accumulated_sent_length>] OK Or: ERROR	Optional parameters are used only for UDP connections. If the Destination IP and Destination Port are not provided by the user, a datagram is sent to the last target (or the default target provided by the +MIPOPEN command). <accumulated_sent_length> - this parameter counts how many bytes were sent to the remote side by the C24 TCP/IP stack. When user open socket, <accumulated_sent_length> initialized to zero. Size of <accumulated_sent_length> is four octets unsigned digit (0-4294967295). <Status>: 0 - Success 1 - socket is flowed off 2 - there is no data in socket to send
<b>Read</b>	+MIPPUSH?	MIPPUSH:[<socket ID>]	
<b>Test</b>	+MIPPUSH=?	MIPPUSH=<socket ID>,<IP>,<Port>	

The following table shows the +MIPPUSH parameters.

**Table 3-97: +MIPPUSH Parameters**

<Parameter>	Description
<b>Socket ID</b>	1,2,3,4 Number of valid socket
<b>Destination IP</b>	IP of destination site in the format AAA.BBB.CCC.DDD. The value can be written in 1, 2 or 3 digits.
<b>Destination Port</b>	0-65535 Port of destination site. Written in decimal digits.

### Example

```
AT+MIPPUSH=1           //Terminal asks the C24 to flush the buffer in socket 1 (was opened
                        using the +MIOPEN command)

+MIPPUSH: 0
OK
```

## +MIPFLUSH, Flush Data from Buffers

This command causes the C24 to flush (delete) data accumulated in its accumulating buffers.

Command Type	Syntax	Response/Action
<b>Set</b>	+MIPFLUSH = <Socket ID>	<b>ERROR</b> or: +MIPFLUSH: <Socket ID> <b>OK</b>
<b>Read</b>	+MIPFLUSH?	+MIPFLUSH:[<socket ID>]
<b>Test</b>	+MIPFLUSH=?	+MIPFLUSH=(<Socket ID>)

The following table shows the +MIPFLUSH parameters.

**Table 3-98: +MIPFLUSH Parameters**

<Parameter>	Description
<b>Socket ID</b>	1,2,3,4 - Number of valid sockets

**Example**

```

AT+MIPFLUSH=2           //Socket number 2 was previously opened using the +MIOPEN
                           command
+MIPFLUSH: 2
OK
AT+MIPFLUSH=5
ERROR
AT+MIPFLUSH?
+MIPFLUSH: 1 2
OK

```

**+MIPRUDP, Receive Data from UDP Protocol Stack**

This unsolicited event is sent by the C24 to the terminal when data is received from the UDP protocol stack.

**Note:** Data in the +MIPRUDP unsolicited report is limited to 80 characters.

**Set Command Event**

```
+MIPRUDP:<Source IP>,<Source Port><socket ID>,<Left>,<Data>
```

The following table shows the +MIPRUDP parameters.

**Table 3-99: +MIPRUDP Parameters**

<Parameter>	Description
<b>Source IP</b>	IP of the source
<b>Source Port</b>	Port of the source
<b>Socket ID</b>	1,2,3,4 - Number of valid sockets.
<b>Left</b>	Size of received Data still left in protocol stack.
<b>Data</b>	Data string received with 0-F hexadecimal digits. String ends with a <CR>.

**Example**

```
+MIPRUDP: 172.16.3.135,222,2,0,44444444
```

**+MIPRTCP, Receive Data from TCP Protocol Stack**

This unsolicited event is sent by the C24 to the terminal when data is received from the TCP protocol stack.

**Note:**

1. In case of SSL secured connection, the encryption increases the amount of data and SSL protocol uses encrypted alerts, therefore the <Left> parameter shows gross encrypted amount of data (including encrypted alert messages) still left in protocol stack, which is greater than actual amount of decrypted data.
2. Data in the +MIPRTCP unsolicited report is limited to 80 characters.



## Set Command Event

**+MIPRTCP:** <socket ID>,<Left>,<Data>

The following table shows the +MIPRTCP parameters.

**Table 3-100: +MIPRTCP Parameters**

<Parameter>	Description
<b>Socket ID</b>	1,2,3,4 - Number of valid sockets.
<b>Left</b>	Size of received Data still left in protocol stack.
<b>Data</b>	Data string received with 0-F hexadecimal digits. String ends with a <CR>.

## Example

**+MIPRTCP:** 3,0,7171

## +MIPSTAT, Status Report

This unsolicited event is sent to the terminal indicating a change in status. Currently there are two possible sources of failure, a broken logical connection or a broken physical connection.

**Note:** In case of SSL secured connection, the encryption increases the amount of data and SSL protocol uses encrypted alerts, therefore the <number\_of\_acknowledged\_bytes> parameter shows gross number of acknowledged bytes (including encrypted alert messages), which is greater than actual amount of sent user data.

## Syntax

**+MIPSTAT:** <socket\_ID>,<n>[,<number\_of\_acknowledged\_bytes >]

The following table shows the +MIPSTAT parameters.

**Table 3-101: +MIPSTAT Parameters**

<Parameter>	Description
<b>&lt;SocketID&gt;</b>	1,2,3,4 - Number of valid sockets.
<b>&lt;n&gt;</b>	0 - ACK indication 1 - Broken protocol stack 2 - Connection closed automatically due to non - fatal alert
<b>&lt;number_of_acknowledged_bytes &gt;</b>	Total number of bytes that were acknowledged

## Example

**+MIPSTAT:** 1,2

## MIPXOFF, Flow Control - Xoff

This command is the unsolicited response that the C24 sends to the terminal to stop sending data when:

- It does not have enough memory to process new +MIPSEND requests. All C24 buffers are full.
- It has received Window size=0 from the remote side (TCP flow control). As a result of that TCP stack may not send data to the remote and may not accept a new data from accumulating buffer.
- When TCP connection established, and ACK messages is not received from the network for 8 different sent packages, a MIPXOFF report will be sent to the terminal.

### Event

**+MIPXOFF: <Socket ID>**

### Example

**+MIPXOFF:** *//The C24 detects that the accumulating buffer 1 has reached its Xoff watermark.*

From this point, the terminal is not allowed to send data, until it receives the +MIPXON command.

## MIPXON, Flow Control - Xon

This command is the unsolicited event that the C24 sends to the terminal when it detects that it has free memory in the accumulating buffer and can process new +MIPSEND requests, after the +MIPXOFF event.

### Event

**+MIPXON: <Socket ID>**

### Example

**+MIPXON: 1** *//The C24 pushed the data into the protocol stack on socket 1 and is able to handle more data from the terminal.*

## +MIPCONF - Configure Internal TCP/IP stack

This command allows configuring TCP stack parameters, such as retransmissions number, upper and bottoming limits of retransmission timeout, close delay. It can be used to configure TCP socket parameters before socket activation or when the socket is in active state. Configuration values will be stored in C24 until power circle.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MIPCONF=<socket>[,<retr_num>],[<min_TO>],[<max_TO>],[<max_close_delay>],[<is_nack_ind_req>]]	<b>OK</b> or: +CME ERROR: <err>	The Set updates TCP stack configuration parameters.
<b>Read</b>	+MIPCONF?	+MIPCONF: 1,<retr_num>,<min_TO>,<max_TO>,<max_close_delay>,<is_nack_ind_req> <CR><LF> +MIPCONF: 2,<retr_num>,<min_TO>,<max_TO>,<max_close_delay>,<is_nack_ind_req> <CR><LF> +MIPCONF: 3,<retr_num>,<min_TO>,<max_TO>,<max_close_delay>,<is_nack_ind_req> <CR><LF> +MIPCONF: 4,<retr_num>,<min_TO>,<max_TO>,<max_close_delay>,<is_nack_ind_req>	The read command returns current settings of TCP stack parameters.
<b>Test</b>	+MIPCONF=?	+MIPCONF: (1-4),(1-5),(1-10),(10-600),(1-75),(0-2)	The Test command returns the possible parameters values. Time values can be inserted with resolution of 100 milliseconds.

The following table shows the +MIPCONF command parameters.

**Table 3-102: +MIPCONF Parameters**

Parameter	Description
<socket>	Number of configured TCP socket (1 to 4)
<retr_num>	Number of retransmissions (1 to 5)
<min_TO>	Bottom limit to retransmit timeout (100 ms to 1 sec.)
<max_TO>	Upper limit to retransmit timeout (1 sec. to 60 sec.)

**Table 3-102: +MIPCONF Parameters**

Parameter	Description
<b>&lt;max_close_delay&gt;</b>	Closing delay required by RFC 793 (100 ms to 7500 ms)
<b>&lt;is_nack_ind_req&gt;</b>	<p>NACK/ACK TCP indication feature.</p> <p>Activating this parameter enables C24 to report the user, in case of losing a TCP connection, what data was received by the remote TCP layer.</p> <p>0 - feature inactive.</p> <p>1 - NACK indication active.</p> <p>2 - ACK indication active.</p> <ul style="list-style-type: none"> <li>• Power Up - 0</li> <li>• Default value - previously set value</li> </ul> <p>This parameter resets after power cycle.</p>

**Example**

```

AT+MIPCONF=2,5,10,600,75,2
OK
AT+MIPOPEN=2,0,"66.249.87.99",80,0
OK
+MIPOPEN: 2,1
AT+MIPSETS=2,10
+MIPSETS: 0
OK
AT+MIPSEND=2,"474554202F20485454502F312E300D0A486F73743A207777772E676F6F676C652E636
F6D0D0A0D0A"
+MIPPUSH: 2,0,40
+MIPSEND: 2,0,1372
OK
+MIPXOFF: 2
AT+MIPSEND=2,"474554202F20485454502F312E300D0A486F73743A207777772E676F6F676C652E636
F6D0D0A0D0A"
+MIPSEND: 2,1,1372
OK
+MIPSTAT: 2,0,30
+MIPXON: 2
+MIPSTAT: 2,0,40
+MIPRTCP: 2,530,485454502F312E312033303220466F756E640D0A4C6F636174696F6E3A206874
74703A2F2F7777772E676F6F676C652E636F2E696C2F63786665723F633D505245462533443A544D25334
43131313935
+MIPRTCP: 2,450,31343833323A5325334467384A637631426A5458472D30636A5926707265763D
2F0D0A5365742D436F6F6B69653A20505245463D49443D363930376262383735313862663233373A43523D
313A544D3D
+MIPRTCP: 2,370,313131393531343833323A4C4D3D313131393531343833323A533D644F656476
7A6C34765F7059475A384A3B20657870697265733D53756E2C2031372D4A616E2D323033382031393A31
343A30372047
+MIPRTCP:
2,290,4D543B20706174683D2F3B20646F6D61696E3D2E676F6F676C652E636F6D0D0A436F6E74656E74
2D547970653A20746578742F68746D6C0D0A5365727665723A204757532F322E310D0A436F6E74656E
+MIPRTCP:
2,210,742D4C656E6774683A203231370D0A446174653A205468752C2032333204A756E20323030352030383
A32303A333220474D540D0A436F6E6E656374696F6E3A20636C6F73650D0A0D0A3C48544D4C3E3C

```

+MIPRTCP:

2,130,484541443E3C5449544C453E333032204D6F7665643C2F5449544C453E3C2F484541443E3C424F44593E0A3C48313E333032204D6F7665643C2F48313E0A54686520646F63756D656E7420686173206D

+MIPRTCP:

2,50,6F7665640A3C4120485245463D22687474703A2F2F777772E676F6F676C652E636F2E696C2F63786665723F633D505245462533443A544D253344313131393531343833323A5325334467384A637631

+MIPRTCP:

2,0,426A5458472D30636A5926616D703B707265763D2F223E686572653C2F413E2E0D0A3C2F424F44593E3C2F48544D4C3E0D0A

+MIPSTAT: 2,1,40

## +MPING, Start Ping Execution (ICMP Protocol)

This command allows verifying IP connectivity to another remote machine (computer) by sending one or more Internet Control Message Protocol (ICMP) Echo Request messages. The receipt of corresponding Echo Reply messages are displayed, along with round trip times.

Valid IP address must be obtained using AT+MIPCALL command prior to starting ping execution.

Only one ping request execution will be allowed at any given moment.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MPING=<mode>[,<"Destination IP/hostname">[,<count>[,<size>[,<TTL>[,<TOS>[,<TimeOut>]]]]]	OK or: +CME ERROR: <err>	The set command shall send a <count> Internet Control Message Protocol (ICMP) Echo Request messages to a target node defined by <"Destination IP/hostname"> parameter.  If <mode> is equal 0, no parameters trailing <mode> parameter are allowed, otherwise ERROR message will be reported to DTE. If <mode> is equal 0, MS will abort sending Echo Request messages if ping request is in process, otherwise ERROR message will be reported to DTE.
<b>Unsolicited Response</b>		+MPING: <"Destination IP">,<type>,<code>[,<RTT>]	The receipt of corresponding ICMP Echo Reply messages will be displayed within unsolicited responses, along with round trip times.

Command Type	Syntax	Response/Action	Remarks
<b>Read</b>	<b>+MPING?</b>	<b>+MPING: &lt;count&gt;, &lt;size&gt;,&lt;TTL&gt;, &lt;TOS&gt;,&lt;TimeOut&gt;</b>  <b>OK</b>	The read command displays currently selected parameters values for +MPING set command. If ping sending procedure is currently in process then user selected parameters for AT+MPING command will be displayed, otherwise default parameter values will be displayed.
<b>Test</b>	<b>+MPING=?</b>	<b>+MPING: (List of supported &lt;mode&gt;s),(Range of &lt;count&gt;s),(Range of &lt;size&gt;s),(Range of &lt;TTL&gt;s), (Range of &lt;TOS&gt;s),( Range of &lt;TimeOut&gt;s)</b>  <b>OK</b>	The test command displays all supported parameters values for +MPING set command.

The following table shows the +MPING command parameters.

**Table 3-103: +MPING Command Parameters**

<Parameter>	Description
<b>&lt;mode&gt;</b>	0 - Abort current ping request execution. 1 - Launch new ping request. There is no default value - appropriate ERROR will be displayed if parameter is not supplied.
<b>&lt;"Destination IP/hostname"&gt;</b>	Specifies the target machine (computer), which is identified either by IP address 4 octets long in dotted decimal notation or by host name of maximum 255 (not including double quotes) characters long in dotted notation. Each octet of IP address has valid value range of 0 to 255. Host names are not case sensitive and can contain alphabetic or numeric letters or the hyphen. There is no default value - appropriate ERROR will be displayed if parameter is not supplied.
<b>&lt;count&gt;</b>	Specifies a number of Internet Control Message Protocol (ICMP) Echo Request messages to send. Valid value range is from 1 to 255. Default value: 4
<b>&lt;size&gt;</b>	Specifies the length, in bytes, of the Data field in the Echo Request messages sent. The minimum size is 0. The maximum size is 1372. Default value: 32

**Table 3-103: +MPING Command Parameters (Cont.)**

<b>&lt;Parameter&gt;</b>	<b>Description</b>
<b>&lt;TTL&gt;</b>	Time To Live (TTL). Specifies number of hops (hop is one step, from one router to the next, on the path of a datagram on an IP network), which the Echo Request message may be routed over. The value is set by using TTL field in IP header. Valid value range is from 1 to 255. Default value: 64
<b>&lt;TOS&gt;</b>	The Type Of Service (TOS) is for internet service quality selection. The type of service is specified along the abstract parameters precedence, delay, throughput, and reliability. These abstract parameters are to be mapped into the actual service parameters of the particular networks the datagram traverses. Minimum and maximum values for TOS are 0 and 255 respectively. Refer to RFC 791 and RFC 2474 which obsoletes RFC 791 for TOS defined values. Default value: 0
<b>&lt;TimeOut&gt;</b>	Specifies the amount of time, in milliseconds, to wait for the Echo Reply message that corresponds to a sent Echo Request message, measured after Echo Request message was sent. If the Echo Reply message is not received within the time-out, +MPINGSTAT unsolicited response, with <status> equal to 1, will be sent to DTE. Valid value range is from 500 ms to 600,000 ms (10 minutes). Default value: 4000

The following table shows the +MPING unsolicited response parameters.

**Table 3-104: +MPING Unsolicited Response Parameters**

<Parameter>	Description
<"Destination IP">	Specifies the message sender machine (computer), which is identified by IP address 4 octets long in dotted decimal notation. Each octet of IP address has valid value range of 0 to 255. The message sender machine (computer) may be either the target of Echo Request message (if a response was an Echo Reply message) or a gateway (router) in a path of Echo Request message passage for any other ICMP response message.
<type>	The first octet of the ICMP header is a ICMP type field, which specifies the format of the ICMP message. Refer to IETF RFC 792 for <type> valid values.
<code>	The reasons for the non-delivery of a packet are described by code field value of ICMP header. Every <type> has its own defined <code> values. Refer to IETF RFC 792 for <code> valid values.
<RTT>	Specifies Round Trip Time (RTT) measured in milliseconds. This parameter will be reported in command response only if Echo Reply message was received.

**Notes:**

1. Ping request is being executed from the moment the valid AT+MPING set command was received by C24 until +MPINGSTAT unsolicited report with <status> equal either to 0 or 2 is sent to DTE or ping request execution was aborted with AT+MPING=0 command. Refer to description of +MPINGSTAT unsolicited response for details.
2. In some cases, the reply message for an Echo Request message might be not an Echo Reply messages but rather some other ICMP message, which is reporting an error in datagram processing. For purpose of reporting an exact type of response for sent Echo Request message, unsolicited response includes <type> and <code> fields.  
The first octet of the data portion of the IP datagram is an ICMP <type> field. The value of this field determines the format of the remaining data. The <type> and <code> fields jointly define ICMP message type.  
For example, a case when an Echo Request message encapsulated in IP datagram to be forwarded by a gateway has exceeded TTL (equal zero). In this case the gateway must discard the datagram and may return an ICMP Time Exceeded message.



**Example**

```

AT+MIPCALL=1
OK
+MIPCALL: 10.170.4.111
AT+MPING=1,"10.170.4.112"    // Ping remote computer using default parameters
OK

+MPING: "10.170.4.112",0,0,400    //Echo Reply message received, RTT is 400 ms.

+MPING: "10.170.4.112",0,0,420

+MPING: "10.170.4.112",0,0,440
+MPING: "10.170.4.112",0,0,410

                                //Ping request execution is completed. Four Echo Request
                                messages were sent, and four //Echo Reply messages
                                were received. Average RTT is 417 milliseconds.
+MPINGSTAT: 0,"10.170.4.112",4,4,417

```

**+MPINGSTAT, Status Update for +MPING Execution**

This is the unsolicited response that the C24 sends to the terminal to inform of ping execution status update and to provide summary statistics of ping request when ping request execution is completed.

Command Type	Syntax	Response/Action	Remarks
<b>Unsolicited Response</b>		+MPINGSTAT: <status>[,<"Destination IP">,<SentMessages>,<ReceivedMessages>[,<AverageRTT>]]	The receipt of corresponding ICMP Echo Reply messages will be displayed within unsolicited responses, along with round trip times.

The following table shows the +MPINGSTAT unsolicited response parameters.

**Table 3-105: +MPINGSTAT Unsolicited Response Parameters**

<Parameter>	Description
<status>	<p>Specifies a status of ping request execution.</p> <p>Defined values:</p> <p>0 - The unsolicited response with this &lt;status&gt; will be sent to DTE upon completion of ping request. If ping request was aborted or socket connection was terminated for any reason, this unsolicited response will not be reported to DTE.</p> <p>1 - The unsolicited response with this &lt;status&gt; will be sent to DTE if no ICMP reply message was received within timeout.</p> <p>2 - The unsolicited response with this &lt;status&gt; will be sent to DTE if socket connection was terminated for any reason. This status essentially means that ping request execution was aborted.</p> <p>3 - Flow Control OFF. The unsolicited response with this &lt;status&gt; will be sent to DTE if phone doesn't have enough memory to process sending an Echo Request message.</p> <p>4 - Flow Control ON. The unsolicited response with this &lt;status&gt; will be sent to DTE if phone has enough memory to send an Echo Request message after flow control was OFF.</p>
<"Destination IP">	<p>Specifies the target machine (computer) for ping request, which is identified by IP address 4 octets long in dotted decimal notation. Each octet of IP address has valid value range of 0 to 255.</p>
<SentMessages>	<p>Specifies a total number of sent Echo Request messages.</p>
<ReceivedMessages>	<p>Specifies a total number of received Echo Reply messages corresponding to Echo Request messages.</p>
<AverageRTT>	<p>Specifies average Round Trip Time (RTT) for this ping request. This value will be reported if and only if &lt;ReceivedMessages&gt; value is greater than zero. Calculation of this value comprises of accumulating all RTT values and dividing total accumulated RTT by &lt;ReceivedMessages&gt; value. Only an integral part of a result will be reported and any digits of a fraction part will be truncated.</p>

**Example**

```
AT+MIPCALL=1,"internet"
```

```
OK
```

```
+MIPCALL: 10.170.4.111
```

```
//Ping host www.motorola.com 3 times with <TTL>=255. All other parameters are default.
```

```
AT+MPING=1,"www.motorola.com",3,,255
```

```
OK
```

```
//ICMP Echo Reply message received, RTT is 522 ms.
```

```
+MPING: "88.221.5.223",0,0,522
```

```
+MPINGSTAT: 1 // No corresponding reply within timeout.
```

```
+MPINGSTAT: 3 // Flow Control OFF.
```

```
+MPINGSTAT: 4 // Flow Control ON, a new Echo Request message is sent immediately.
```

```
+MPING: "88.221.5.223",0,0,638
```

```
//Ping request execution is completed. Statistics displayed to terminal. Three Echo Request messages were sent, and two Echo Reply messages were received. Average RTT is 580 milliseconds.
```

```
+MPINGSTAT: 0,"88.221.5.223",3,2,580
```

```
//Ping host www.motorola.com 1 time with <TTL>=1 and <size>=1372.
```

```
AT+MPING=1,"www.motorola.com",1,1372,1
```

```
OK
```

```
//ICMP Time Exceeded message received. TTL expired in transit.
```

```
+MPING: "192.168.252.65",11,0
```

```
//Ping request execution is completed.
```

```
+MPINGSTAT: 0,"88.221.5.223",1,0
```

## +MSDNS, Set DNS IP Address

This command set/read DNS (Domain Name Server) IP address (primary/secondary). If the user doesn't specify DNS servers by AT+MSDNS, C24 will use default DNS from NW. The defined value(s) will be saved during disconnect PDP context (can be used in next PDP context), but will reset after power cycle.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MSDNS=[<Socket_id>[, <Primary DNS server IP> [,<Secondary DNS server IP>]]]	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	
<b>Read</b>	AT+MSDNS?	+MSDNS: 1,<Primary DNS server IP>,< Secondary DNS server IP><CR><LF> +MSDNS: 2,<Primary DNS server IP>,< Secondary DNS server IP><CR><LF> +MSDNS: 3,<Primary DNS server IP>,< Secondary DNS server IP><CR><LF> +MSDNS: 4,<Primary DNS server IP>,< Secondary DNS server IP><CR><LF> +MSDNS: 5,<Primary DNS server IP>,< Secondary DNS server IP><CR><LF> <CR><LF> <b>OK</b>	
<b>Test</b>	AT+MSDNS=?	+MSDNS: (List of supported <Socket_id>s),(<IP>),(<IP>)	

The following table shows the +MSDNS parameters.

**Table 3-106: +MSDNS Parameters**

<Parameter>	Description
<b>&lt;Socket_id&gt;</b>	A unique number that identifies a connection (provided by the terminal application). 0 - Invalid socket number 1,2,3,4 - Valid socket number 5 - Valid socket number dedicated to +MPING.
<b>&lt;Primary DNS server IP&gt;, &lt;Secondary DNS server IP&gt;</b>	IP of the destination site in the format "AAA.BBB.CCC.DDD". The range of each octant is 0-255. The value can be written in 1, 2, or 3 digits.

**Example**

```

AT+MSDNS=?
+MSDNS: (1-5),(<IP>),(<IP>)
OK
AT+MSDNS? // read when MIPCALL is disconnected
+MSDNS: 1,"0.0.0.0","0.0.0.0"
+MSDNS: 2,"0.0.0.0","0.0.0.0"
+MSDNS: 3,"0.0.0.0","0.0.0.0"
+MSDNS: 4,"0.0.0.0","0.0.0.0"
+MSDNS: 5,"0.0.0.0","0.0.0.0"
OK
AT+MSDNS=2,"212.150.49.10","206.49.94.234" //set socket 2 prim & sec DNS
OK
AT+MSDNS? // read when MIPCALL is disconnected
+MSDNS: 1," 212.150.49.10","206.49.94.234"
+MSDNS: 2,"212.150.49.10","206.49.94.234"
+MSDNS: 3,"212.150.49.10","206.49.94.234"
+MSDNS: 4,"212.150.49.10","206.49.94.234"
+MSDNS: 5,"212.150.49.10","206.49.94.234"
OK
AT+MIPCALL=1
OK
+MIPCALL: 10.170.7.91

AT+MSDNS= // all sockets set to default values
OK
AT+MSDNS?
+MSDNS: 1,"192.118.9.177","192.118.11.77"
+MSDNS: 2,"192.118.9.177","192.118.11.77"
+MSDNS: 3,"192.118.9.177","192.118.11.77"
+MSDNS: 4,"192.118.9.177","192.118.11.77"
+MSDNS: 5,"192.118.9.177","192.118.11.77"
OK
AT+MIPCALL=0
OK
NO CARRIER
+MIPCALL: 0
AT+MSDNS? // read when MIPCALL is disconnected
+MSDNS: 1,"0.0.0.0","0.0.0.0"
+MSDNS: 2,"0.0.0.0","0.0.0.0"
+MSDNS: 3,"0.0.0.0","0.0.0.0"
+MSDNS: 4,"0.0.0.0","0.0.0.0"
+MSDNS: 5,"0.0.0.0","0.0.0.0"
OK

```

**+MIPCFF, Control Filtering List**

The filtering feature aims to protect the C24 module from non-authorized clients trying to establish an IP connection with it. It is applicable for cases where C24 communicates as a listener with others devices.

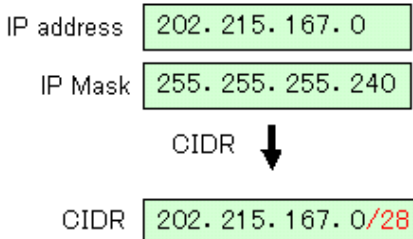
The filtering feature consists of "white list" defined per connection. The "white list" can be configured when filtering feature is set to disable and before connection is established. Once a connection is established, changes in its "white list" are forbidden.

The following services are provided by the C24 on behalf the "white list" management:

- Disable/Enable filtering on a connection;
- Add/Remove IP to/from "white list";
- Clear "white list"

After Power-up, the "white list" will be empty and disabled for all connections.

<b>White List</b>	List of IP addressed that represent devices which are allowed to establish an IP connection with C24. The white list is defined per connection.
<b>Listen Mode</b>	A mode in which the module expects to received data from the other side.
<b>IP CIDR</b>	An efficient way to represent range of IP_Addresses. It composed of "IPaddr/A", where: IP_address's format is "AAA.BBB.CCC.DDD", /A indicates that the subnet mask would start with A 1 bits. See <a href="#">Figure 3-3</a> .



**Figure 3-3: CIDR Scheme**

Command Type	Syntax	Response/Action
<b>Set</b>	+MIPCFF = <Socket ID>,<CmdType>,[ "<IP>" ]	<b>Comment:</b> IP in IP CIDR presentation <b>OK</b> <b>or:</b> +CME: <error code>

Command Type	Syntax	Response/Action
<b>Read</b>	<b>+MIPCFF?</b>	+MIPCFF: 1,<STATUS>,<IP1.1>,<IP1.2>...<IP1.n> +MIPCFF: 2,<STATUS>,<IP2.1>,<IP2.2>...<IP2.n> +MIPCFF: 3,<STATUS>,<IP3.1>,<IP3.2>...<IP3.n> +MIPCFF: 4,<STATUS>,<IP4.1>,<IP4.2>...<IP4.n>
<b>Test</b>	<b>+MIPCFF=?</b>	+MIPCFF=(1-4),(0-4),("IP in CIDR notation") <b>OK</b> <b>or:</b> +CME: <error code>

The following table shows the +MIPCFF parameters.

**Table 3-107: +MIPCFF Parameters**

<Parameter>	Description	Value
<b>&lt;Socket_id&gt;</b>	Identification Number of Sockets.	0 - Invalid socket number. 1, 2 ... Max (=4).
<b>&lt;CmdType&gt;</b>	Operation that should be accomplished.	0 - Disable filtering. 1 - Enable filtering. 2 - Add IP to white list. 3 - Remove IP from white list. 4 - Clear IP white list.
<b>&lt;IP&gt;</b>	IP for an allowed node.	IP in format AAA.BBB.CCC.DDD. The range of each octant is 0-255. Value can be written in 1,2,3 digits. Fixed bit A: The range is 1 - 32. Value can be written in 1 or 2 digits.
<b>&lt;Status&gt;</b>	Indicate filtering status on socket.	0 - Disabled. 1 - Enabled. 2- Not applicable - the socket is opened as client (not as listen) socket.

The following table shows the +MIPCFF filtering error codes and status.

**Table 3-108: Filtering Error Codes and Status**

<Parameter>	Description	Value
<b>Error Codes</b>	Extended error codes.	3 - Operation not allowed. 20 - Memory full. 22 - Not found. 35 - Text parameter instead of numeric parameter. 36 - Numeric parameter out of bounds. 282 - Inactive socket.
<b>Status&gt;</b>	Socket filtering status.	2 - Not applicable. 1 - Enabled. 0 - Disabled.

**Notes:**

- The filtering feature can be enabled or disabled for each socket separately. The filtering feature can be disabled without restrictions. The filtering feature can be enabled only if white list of selected socket is not empty.
- While receiving incoming TCP connection, in case that filtering feature is enabled and listen socket was opened to listen for any IP address (remote IP specified as "0.0.0.0"), it will check the remote IP and accept connection only if the white list has entry with IP and number of most significant bits, so the number of most significant bits are identical both in remote IP address and IP address, stored in white list.
- There is a separate white list for each socket. The capacity of each white list is 12 entries.
- The white list can be configured (by Add/Remove IP CIDR to/from "white list" or Clear "white list" commands) only if selected socket is closed and filtering feature is disabled for this socket.
- The filtering feature can be configured without relation whether the PDP context is activated or not.
- While waiting for a connection from specific IP (in +MIPOPEN and +MIPODM commands remote IP specified not as "0.0.0.0"), the filtering feature state will not affect the incoming connection.
- The filtering feature does not affect connections that are already established.
- At power recycle, the filtering feature is reset. After power up the feature is disabled for all sockets and white lists are empty for all sockets.



**Example**

```

AT+MIPCFF=?
+MIPCFF: (1-4),(0-4),(" <IP CIDR>")
OK
AT+MIPCFF=2,2,"10.170.255.255/16"// Add to socket 2 rule to accept all IP's that starts with 10.170.*.*
OK
AT+MIPCFF=2,2 // Invalid command
+CME ERROR: operation not allowed
AT+MIPCFF=2,1 // Enable filtering for socket 2
OK
AT+MIPCFF=2,1,"1.2.3.4/5" // Invalid command
+CME ERROR: operation not allowed
AT+MIPCFF=1,1 // White list of socket 1 is empty
+CME ERROR: operation not allowed
AT+MIPCFF? // Terminal checking the filtering configuration
+MIPCFF: 1,0
+MIPCFF: 2,1,10.170.255.255/16
+MIPCFF: 3,0
+MIPCFF: 4,0
AT+MIPCFF=1,3,"10.170.0.0/16" // Remove "10.170.0.0/16" from empty white list
+CME ERROR: not found
AT+MIPCFF=2,0 // Disable filtering for socket 2
OK
AT+MIPCFF=2,3,"10.170.255.255/16"// Remove "10.170.255.255/16" from white list of socket 2
OK
AT+MIPCFF? // Terminal checking the filtering configuration
+MIPCFF: 1,0
+MIPCFF: 2,0
+MIPCFF: 3,0
+MIPCFF: 4,0

```

**+MIPSSL, SSL Alerts Unsolicited Report**

This unsolicited event is sent to the terminal indicating errors, warnings or alerts that occurred during SSL connection.

**Note:** The +MIPSSL alerts are not sent to TE in ODM mode.

**Syntax**

+MIPSSL: <Socket\_ID>,<Alert\_ID>

The following table shows the +MIPSSL parameters.

**Table 3-109: +MIPSSL Parameters**

<Parameter>	Description
<Socket_ID>	1,2,3,4 - Identification Number of Socket.
<Alert_ID>	Alert ID.

The following table shows the +MIPSSL Alerts.

**Table 3-110: +MIPSSL Alerts**

Alert ID	Alert Name	Description
1	SSL_BAD_RECORD_MAC	Returned if a record is received with an incorrect MAC. This alert is fatal.
2	SSL_DECRYPTION_FAILED	Cipher text decrypted in an invalid way: either it wasn't an even multiple of the block length or its padding values, when checked, were not correct. This alert is fatal.
3	SSL_UNEXPECTED_MESSAGE	An inappropriate message was received. This alert should never be observed in communication between proper implementations. This alert is fatal.
4	SSL_ILLEGAL_PARAMETER	A field in the handshake was out of range or inconsistent with other fields. This alert is fatal.
5	SSL_EXPORT_RESTRICTION	A negotiation not in compliance with export restrictions was detected; for example, attempting to transfer a 1024 bit ephemeral RSA key for the RSA_EXPORT handshake method. This alert is fatal.
6	SSL_UNSUPPORTED_PROTOCOL_VERSION	The protocol version the client has attempted to negotiate is recognized, but not supported. (For example, old protocol versions might be avoided for security reasons). This alert is fatal.
7	SSL_INSUFFICIENT_SECURITY	The server requires ciphers more secure than those supported by the client. This alert is fatal.
8	SSL_HANDSHAKE_FAILURE	Indicates that the sender was unable to negotiate an acceptable set of security parameters given the options available. This alert is fatal.
9	SSL_CLOSE_NOTIF	Session was closed by either sides.
10	SSL_BAD_CERTIFICATE	A certificate was corrupt, contained signatures that did not verify correctly, etc.
11	SSL_UNSUPPORTED_CERTIFICATE	A certificate was of an unsupported type (unsupported signature algorithm, public key type, etc.).
12	SSL_CERTIFICATE_REVOKED	A certificate was revoked by its signer.
13	SSL_CERTIFICATE_EXPIRED	A certificate has expired or is not currently valid.
14	SSL_NO_CERTIFICATE	This alert may be sent in response to a certification request if no appropriate certificate is available.
15	SSL_UNKNOWN_CA	A valid certificate chain or partial chain was received, but the certificate was not accepted because the CA certificate could not be located or couldn't be matched with a known, trusted CA.

**Table 3-110: +MIPSSL Alerts**

Alert ID	Alert Name	Description
16	SSL_ACCESS_DENIED	A valid certificate was received, but when access control was applied, the sender decided not to proceed with negotiation. This message is fatal.
17	SSL_DECOMPRESSION_FAILURE	SSL Record failed decompression.
18	SSL_BAD_CERTIFICATE_SIGN	Certificate failed authentication.
19	SSL_BAD_CERTIFICATE_ISSUER	Certificate failed authentication.
20	SSL_HOST_MISMATCH	Host mismatch (Common Name).
21	SSL_CERTIFICATE_UNKNOWN	Some other (unspecified) issue arose in processing the certificate, rendering it unacceptable.
22	SSL_DECRYPT_ERROR	A handshake cryptographic operation failed, including being unable to correctly verify a signature, decrypt a key exchange, or validate a finished message.
23	SSL_RECORD_OVERFLOW	A Cipher text record was received which had a length more than $2^{14}+2048$ bytes. This message is always fatal.
24	SSL_DECODE_ERROR	A message could not be decoded because some field was out of the specified range or the length of the message was incorrect. This message is always fatal.
25	SSL_INVALID	Alert contained invalid ID.
26	SSL_INTERNAL_ERROR	Local error independent of protocol.
27	SSL_USER_CANCELED	Cancel handshake other reasons.
28	SSL_NO_RENEGOTIATION	Can't renegotiate the handshake.
29	SSL_CERT_INFO	Alert for viewing the certificate

**Example**

```
+MIPSSL: 2,15
```

```
// While opening the SSL connection for socket 2, server certificate
// was received, but was not accepted because the CA that
// signed the certificate could not be located or couldn't be
// matched with a known, trusted CA.
```

**+MIPODM, Open a Socket (UDP or TCP) in Online Data Mode**

This command causes the C24 to initialize a new socket that waits for a connection from a remote machine or opens a common or TCP secured with SSL connection with a remote side (according to received parameters) and switch it to Online (raw data transfer) Data Mode and open a connection with a remote side.

- Notes:**
- Online Data Mode allows the user to transfer raw data from terminal to Network and vice versa. Currently, only RS232 connection to terminal with hardware flow control is supported.
  - Each socket allocates an accumulating buffer whose size is 1372 bytes. When the user sends amount of data, less than buffer size, the data is being sent to Network after a spooling timeout (200 mS), otherwise the data is being sent to Network immediately.
  - Only one socket is allowed at the same time in Online Data Mode.
  - The +MIPODM command returns a +MIPSTAT <Socket ID><Error> unsolicited event if it fails. For example, if it was rejected by the remote side.
  - The +MIPODM command returns a +MIPSSL unsolicited event(s) in case of alert(s) occurring during secure connection establishment or in pseudo-command mode.
  - When switch to pseudo command mode it is possible to open until 3 others +MIPOEN sockets, but open another Online Data Mode socket is not allowed.
  - Open a +MIPOPEN connection and then open an ODM connection it is also allowed.
  - +MIPSEND/+MIPPUSH/+MIPSETS are not relevant in case of Online Data Mode connection.
  - When switch to pseudo command mode, and a new data received, an unsolicited report of +MIPDATA will be sent to the terminal.
  - When the C24 is in Online Data Mode and another MIPOPEN socket is exist. All the data that is sent to the module over the MIPOPEN connection will be saved and display to the terminal by +MIPRTCP/+MIPRUDP reports only after the ODM connection switch to pseudo command mode.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MIPODM= <Socket ID>, <Source Port>, <Remote IP>, <Remote Port>, <Protocol>>	OK or: +MIPODM: <Socket ID>,<State>[,<Remote IP>,<Remote Port>] or: +MIPSTAT: <Socket ID>,<Status> or: ERROR: <err>	The Set command returns <Remote IP> and <Remote Port> parameters only for sockets opened in Listen mode.

Command Type	Syntax	Response/Action	Remarks
<b>Read</b>	AT+MIPODM?	+MIPODM:[<SocketID>] for each socket that can be opened or: +MIPODM 0,0 if there are no free sockets.	When a socket opens in Online Data Mode, the command returns actual Socket ID value and '1' value (active). C24 will be in pseudo-command mode for receiving the command.
<b>Test</b>	AT+MIPODM=?	+MIPODM: (list of supported <socket ID>s),(list of supported <source port>s),(list of supported<"Destination IP">s), (list of <destination port>s),(list of supported <protocol>s)	

The following table shows the +MIPODM parameters.

**Table 3-111: +MIPODM Parameters**

<Parameter>	Description
<b>Socket ID</b>	A unique number that identifies a connection. Valid socket numbers - 1,2,3 and 4
<b>Source Port</b>	Port of source site. Port range: 1-65535 (decimal digits)
<b>Remote IP</b>	<b>IP</b> of the remote site in the format "AAA.BBB.CCC.DDD". The range of each octet is 0-255. The value can be written in 1, 2, or 3 digits. <b>Host-name</b> of the remote site. The host-name convention should meet the rules as describe in RFC-1035 section: 2.3 Conventions. Syntax is not validated, except the maximum length (255 characters).
<b>Remote Port</b>	Port of remote site. Port range: 1-65535 (decimal digits) for outgoing connection. Port 0 for incoming connection.
<b>Protocol</b>	Type of protocol stack. 0 TCP 1 UDP 2 TCP secured with SSL
<b>State</b>	0 Inactive 1 Active 2 SSL secured

**Note:** Motorola does not recommend using port numbers below 1024. These numbers are defined to be reserved for operating systems.

### Example

Opening socket 3 in Online Data Mode, using TCP protocol, from port 1104, designation IP 123.245.213.012, designation port 1124:  
AT+MIPODM=3,1104,"172.90.237.221",1124,0

OK

+MIPODM: 3,1

Enter invalid command format:

AT+MIPODM

ERROR

Check opened in Online Data Mode socket state when C24 is pseudo-command mode:

AT+MIPODM?

+MIPODM: 3,1

OK

Listen socket over TCP:

AT+MIPODM=1,1100,"0.0.0.0",0,0 // Listens to any port at any IP.

OK

+MIPODM: 1,1,122.221.32.64,1200 // Remote side connected to the listen socket.

AT+MIPODM=3,3212,"122.1.222.134",0,0 // Listen to any port at specific IP.

OK

+MIPODM: 3,1,122.1.222.134,1222 // Remote side connected to the listen socket.

//SSL

AT+MIPODM=2,2222,"www.google.com",443,2// TCP secured with SSL.

OK

+MIPODM: 2,2 // SSL connection opened.

AT+MIPODM=3,1234,"www.xyz.com",443,2// TCP secured with SSL.

OK

+MIPSSL: 3,15 // SSL\_UNKNOWN\_CA alert.

+MIPODM: 3,2

## **+MIPDATA, Network Incoming Data Unsolicited Indication in Pseudo-command Mode**

This unsolicited event is sent to the terminal indicating a data comes from Network when C24 is in pseudo-command mode.

**Note:** Pseudo-command mode is a special mode, allowing the user to enter AT commands from terminal, when actually opened in Online Data Mode socket suspended. The way to suspend the socket is to enter ESC sequence from terminal. The way to resume the socket (return to Online Data Mode) is to enter ATO command from terminal.

### **Syntax**

+MIPDATA: <Socket ID>,<Number of received data bytes>

The following table shows the +MIPDATA parameters.

**Table 3-112: +MIPDATA Parameters**

<Parameter>	Description
<Socket ID>	Identification Number of Socket: 1,2,3,4
<number of received data bytes >	Amount of data in bytes, received from Network, when C24 is in pseudo-command mode.

### Example

+MIPDATA: 1,1372

## +MIPCSC, Motorola Control Secured Connection

This AT command is used to configure the SSL feature behavior in case of non - fatal alerts. For each non - fatal alert, user should decide if the secure connection should be closed automatically or not.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MIPCSC=<SocketID>,<n>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command is used for setting the SSL connection behavior in case of non - fatal alerts.
<b>Read</b>	AT+MIPCSC?	+ MIPCSC: 1,<n> + MIPCSC: 2,<n> + MIPCSC: 3,<n> + MIPCSC: 4,<n>  <b>OK</b>	The Read command returns the current SSL connection behavior in case of non - fatal alerts.
<b>Test</b>	AT+MIPCSC=?	+ MIPCSC: (1-4),(0- 2047)  <b>OK</b>	The Test command returns the possible range of values.

The following table shows the +MIPCSC parameters.

**Table 3-113: +MIPCSC Parameters**

<Parameter>	Description
<SocketID>	A unique number that identifies a connection. Valid socket numbers - 1, 2, 3 and 4
<n>	b11 . . . b5 b4 b3 b2 b1 Bitmap parameter that represents SSL feature behavior configuration. Every 1 bit indicates whether each alert will cause automatically connection termination or not. Bit value 1 indicates automatically connection termination, 0 indicates that connection will not be terminated in case of such an alert. b1 represents the first alert; b2 represents the 2nd alert, and so on. Values range: 0 - 2047 The list of alerts to configure: 1 - SSL_BAD_CERTIFICATE 2 - SSL_UNSUPPORTED_CERTIFICATE 3 - SSL_CERTIFICATE_REVOKED 4 - SSL_CERTIFICATE_EXPIRED 5 - SSL_NO_CERTIFICATE 6 - SSL_UNKNOWN_CA 10 - SSL_CERTIFICATE_UNKNOWN 11 - SSL_DECRYPT_ERROR For more information about alerts see <a href="#">Table 3-110</a> .

**Notes:** This command allows configuring SSL feature behavior for each socket separately.

This command can be used to configure SSL feature behavior before socket activation or when a socket in active state.

In case of receiving the alert, defined by user as source for closing the connection, the connection is closed and +MIPSTAT: <SocketID>,2 unsolicited report sent to TE.

Configuration value <n> is not stored into non volatile memory (NVM) therefore after power recycle it should be reconfigured.



**Example**

AT+MIPCSC=?  
 +MIPCSC: (1-4),(0-2047):

OK

AT+MIPCSC?  
 +MIPCSC: 1,0  
 +MIPCSC: 2,0  
 +MIPCSC: 3,0  
 +MIPCSC: 4,0

OK

AT+MIPCSC=2,256 // 256 = 00100000000 (binary), so in case of  
 // SSL\_DOMAIN\_NAME\_MISMATCH alert,  
 // connection would be closed automatically.

OK

AT+MIPCSC?  
 +MIPCSC: 1,0  
 +MIPCSC: 2,256  
 +MIPCSC: 3,0  
 +MIPCSC: 4,0

OK

AT+MIOPEN=2,2222,[www.xyz.com](http://www.xyz.com),443,2 // connect to site using SSL protocol

OK

+MIPSSL: 2,19 // SSL\_DOMAIN\_NAME\_MISMATCH alert received.

+MIPSTAT: 2,2 // Connection closed automatically due to received alert.

AT+MIOPEN=1,1111,[www.xyz.com](http://www.xyz.com),443,2 // Connect to site using SSL protocol

OK

+MIPSSL: 1,19 // SSL\_DOMAIN\_NAME\_MISMATCH alert received.

+MIOPEN: 1,2 // Connection established despite of receiving alert.

## \$QCPREV, Protocol Revision in Use

This command returns the protocol revision in use.

Command Type	Syntax	Response/Action
Execute	AT\$QCPREV	Returns one of the following codes: 1 - JSTD008 3 - IS_95A 4 - IS_95B 6 - IS_2000

### Example


```
AT$QCPREV
$QCPREV: 4
OK
```

### TCP Data Transfer Example

```
AT+MIPCALL=1
OK
+MIPCALL: 172.17.242.86
AT+MIPOPEN=1,1222,"123.245.213.012",1234,0 //Opening socket 1 using TCP protocol, from port 1222,
targeting 123.245.213.012 port 1234
OK
+MIPOPEN: 1,1
AT+MIPOPEN? //Terminal checking the status of socket to be opened (socket 1 opened
OK)
+MIPOPEN: 2 3 4
+MIPSETS=1,340 //Asking the C24 to accumulate 340 bytes on socket 1 prior to sending
+MIPSETS: 0
OK
AT+MIPSETS?
+MIPSETS: 1 340
OK
AT+MIPSEND=1,"444444" //Sent coded "DDD" string
+MIPSEND: 1,1497 //Free storage in the accumulating buffer
OK
Note: This step can be repeated several times until the buffer is full or until the amount of data
reaches 340 bytes and data pushed into the stack.

AT+MIPSEND? //Checking the size remaining (optional)
+MIPSEND: 1 1497
OK
+MIPPUSH=1 //Terminal asks C24 to flush the buffer in socket 1
+MIPPUSH: 0
+MIPCLOSE=1 //Terminal closes the socket
+MIPCLOSE: 1
OK
+MIPCALL=0 //Terminal hangs up the link
OK
```

### Multi-point Data Transfer Example



```

AT+MIPCALL=1
OK
+MIPCALL: 172.17.242.86
AT+MIPOPEN=1,1001,"172.17.238.44",1001,0
OK
+MIPOPEN: 1,1
AT+MIPOPEN=2,1111,"172.17.238.44",1111,0
OK
+MIPOPEN: 2,1
+MIPSETS=1,200 //Asking the C24 to accumulate 200 bytes on socket 1 prior to
                  sending
+MIPSETS: 0
OK
+MIPSETS=2,400 //Asking the C24 to accumulate 400 bytes on socket 2 prior to
                  sending
+MIPSETS: 0
OK
+MIPSEND=1,"444444"
+MIPSEND:1,1497
OK
+MIPSEND=2,"DD" //Passing data to the C24 socket 2
+MIPSEND:2,1499
OK
+MIPPUSH=1 //Terminal asks the C24 to flush the buffer in sockets 1 and 2
+MIPPUSH:0
+MIPPUSH=2
+MIPPUSH:0
+MIPCLOSE=1 //Terminal closes sockets 1 and 2
+MIPCLOSE:1
OK
+MIPCLOSE=2
+MIPCLOSE:2
OK
+MIPCALL=0 //Terminal hangs up the link
OK
+MIPSETS=1,120 //Asking the C24 to accumulate 120 bytes on socket 1 prior to
                  sending
+MIPSETS: 0
OK
+MIPSEND=1,"444444" //Passing 3 bytes of data to the C24 socket 1
Note: Size remaining in socket 1 buffer is 1497 bytes.
+MIPSEND:1,1497
+MIPPUSH=1 //At this point, the terminal can decide on flushing the remainder to
the stack

```

### Xoff and Xon Example


In this example, it is assumed that the buffer size is 1500 and that some kind of error happened on the protocol stack.

```
+MIPSEND=1,"A344343ABC343438980BC...AB4" //Passing data to C24 socket 1
```

```
+MIPSEND:1,1200          //(Note: Size remaining in socket 1 accumulating buffer is 1200 bytes.)
+MIPSEND=1,"A344343ABC343438980BC...A23"
+MIPSEND:1,0             //(Note: No free space in buffer.)
+MIPXOFF: 1              //(The C24 detects that the accumulating buffer on socket 1 has no
free space to accumulate data and data cannot be sent to the protocol stack.
From this point on, the terminal is not allowed to send data until it receives the +MIPXON
command.
+MIPSEND=1,A344343ABC343438980BC...AB4//Terminal disregards the Xoff request of C24 and keeps
sending //(Note: The terminal does not stop.)
ERROR 3
+MIPXON: 1               //C24 pushed the data into the protocol stack and is able to handle
more sends from the terminal
```

### Error in Reopening a Valid Socket

```
AT+MIPCALL=1
OK
+MIPCALL:123.145.167.230
+MIOPEN=1,1222,"123.245.213.012",1234,0 //Opening socket 1 using TCP protocol, from port 1222,
targeting 123.245.213.012 port 1234
OK
+MIOPEN:1,1
+MIOPEN?                //Terminal checking the status of socket to be ready
+MIOPEN: 2 3 4
MIOPEN=1,12,123.245.213.012,234,0//Terminal tries to reopen socket 1
ERROR
```



## FTP (File Transfer Protocol)

### Overview

FTP or file transfer protocol feature enables the C24 module (the user) to communicate with another computer/module (the server) over the Internet so that the user can perform file commands (Get/Put) and file/directory management on the other computer. This is done by implementing the FTP protocol RFC-959.

### Interaction with Other MIP Commands

The external ODM session is prohibit when FTP feature executed, because FTP feature data connection based on socket, opened for ODM (internal ODM session), so when C24 receives +MIPODM command within FTP connection, the error code: 302 (FTP session is active) returns to the user.

### Interaction with +MIPOPEN and +MIPCLOSE Commands

The user cannot initiate FTP connection with +MIPOPEN command as well as close FTP connection with +MIPCLOSE command. However, +MIPOPEN and +MIPCLOSE commands in "read" state still indicate actually used / unused sockets include sockets, allocated for active FTP connection:

- AT+MIPOPEN? indicates inactive sockets (include allocated for active FTP connection)
- AT+MIPCLOSE? indicates active sockets (include allocated for active FTP connection)

When C24 receives +MIPCLOSE command for close a socket, used within FTP connection, the error code: 302 (FTP session is active) returns to the user.

## Session Commands

### +FTPOPEN, Open FTP Connection Between C24 (FTP client) and Remote FTP Server

This command causes C24 to open a FTP connection with a remote FTP server, based on given parameters.

- Notes:**
- Only one FTP connection can be in progress at the same time.
  - FTP connection is based on two TCP sockets: one of them configured for Online Data Mode.
  - Online Data Mode connection is prohibited when FTP connection is in progress and vice versa.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+FTPOPEN= <"destination_ip/url">,<"username">,<"password">[,<"account">,<source_control_port>,<destination_control_port>,<source_data_port>]	<b>OK</b>  +FTPOPEN: <connection_status>  <b>Or:</b>  <b>ERROR:</b> <error_code>	Command execution result (connection status) return to the user as an unsolicited response: <b>1</b> - connection succeeded <b>0</b> - connection failed
<b>Read</b>	+FTPOPEN?	+FTPOPEN: <connection_status>  <b>OK</b>	Returns FTP connection status:  <b>1</b> - connected <b>0</b> - not connected
<b>Test</b>	+FTPOPEN=?	+FTPOPEN: (<destination_ip/url>), (<username>),(<password>) [,(<account>), (range of supported port's), (range of supported port's), (range of supported port's)] <b>OK</b>	

The following table shows the +FTPOPEN parameters.

**Table 3-114: +FTPOPEN Parameters**

<Parameter>	Description	Range
<b>destination_ip/url<sup>1</sup></b>	IP or URL of destination site.	IP address in dotted decimal notation form: XXX.XXX.XXX.XXX. URL: string, max length is <b>255</b> octets.
<b>username<sup>2</sup></b>	Username for FTP login procedure.	ASCII chars, max length is <b>255</b> octets.
<b>password<sup>3</sup></b>	Password for FTP login procedure.	ASCII chars, max length is <b>255</b> octets.
<b>account<sup>4</sup></b>	User Account for FTP login procedure.	ASCII chars, max length is <b>255</b> octets.
<b>source_control_port<sup>5</sup></b>	Port for FTP control connection on source side.	Number in <b>0-65535</b> range.
<b>destination_control_port<sup>5</sup></b>	Port for FTP control connection on remote side.	Number in <b>0-65535</b> range.
<b>source_data_port<sup>6</sup></b>	Port for FTP data connection on source side.	Number in <b>0-65535</b> range.

**Note:** Motorola does not recommend using source port numbers below 1024. These numbers are defined to be reserved for operating system.

**Notes:**

- <sup>1</sup> Mandatory parameter.
- <sup>2</sup> Mandatory parameter. Use "anonymous" user name for anonymous connection.
- <sup>3</sup> Mandatory parameter. For anonymous connection use "**guest**" or valid e-mail address or an empty string ("").
- <sup>4</sup> Optional parameter, default value is empty string ("").
- <sup>5</sup> Optional parameter, default value is 21.
- <sup>6</sup> Optional parameter, default value is 20.

## Example

The first example illustrates FTP connection open success case.

```
AT+FTPOPEN="someftpsite.com","anonymous","qwerty@somemail.com",,,,  
OK  
+FTPOPEN: 1
```

The second example illustrates FTP connection open error case, because another FTP connection is already opens. The AT+CMEE=2 command enables verbose error report.

```
AT+CMEE=2  
OK
```

```
AT+FTPOPEN="someftpsite.com","anonymous","qwerty@somemail.com",,,,  
OK
```

```
+FTPOPEN: 1
```

```
AT+FTPOPEN="anotherftpsite.com","anonymous","qwerty@somemail.com",,,,  
+CME ERROR: FTP session is active
```

## +FTPCLOSE, Close Established FTP Connection Between C24 (FTP client) and Remote FTP Server

This command causes C24 to close FTP connection, when no data transfer occurred at that same time. When data transfer is in progress, use DTR line for closing FTP connection.

Command Type	Syntax	Response/Action	Remarks
Set	+FTPCLOSE	OK  +FTPCLOSE: <connection_status>  Or:  ERROR: <error_code>	Command execution result return to the user as an unsolicited response:  1 - connection succeeded 0 - connection failed
Read	+FTPCLOSE?	ERROR	Not supported
Test	+FTPCLOSE=?	ERROR	Not supported

## Example

The first example illustrates FTP connection close success case.

```
AT+FTPCLOSE  
OK
```

```
+FTPCLOSE: 1
```

The second example illustrates FTP connection close error case, because no FTP connection was open. The AT+CMEE=2 command enables verbose error report.



AT+CMEE=2  
OK

AT+FTPCLOSE  
+CME ERROR: FTP session is inactive

### +FTPINFO, FTP Unsolicited Indication Enable/Disable

This command causes the C24 to enable or disable FTP unsolicited indication to the user. FTP unsolicited indication is used for debugging the FTP session and, when the indication is enabled, the C24 will show the user all FTP commands sent to the remote site and all FTP responses received from the remote side.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+FTPINFO=<indication>	OK  Or:  ERROR: <error_code>	Enables/disables FTP unsolicited indication:  <b>0</b> - Indication disabled <b>1</b> - Indication enabled  When indication is enabled, C24 will send the user all FTP commands and responses using the following unsolicited response format:  +FTPINFO: <data>
<b>Read</b>	+FTPINFO?	+FTPINFO: <indication> OK	Returns FTP indication status:  <b>0</b> - Indication disabled <b>1</b> - Indication enabled
<b>Test</b>	+FTPINFO=?	+FTPINFO: (range of supported <indication>s) OK	Return command format.

The following table shows the +FTPINFO parameters.

**Table 3-115: +FTPINFO Parameters**

<Parameter>	Description	Range
<Indication>	FTP unsolicited indication status.	Numeric in <b>0-1</b> range.

### Example

The example illustrates FTP connection open success case, when FTP unsolicited indication is enabled.

```
AT+FTPINFO=1  
OK
```

```
AT+FTPOPEN="someftpsite.com","anonymous","qwerty@somemail.com",,,  
OK
```

```
+FTPINFO: 220-
```

```
+FTPINFO: 220-Welcome to someftpsite.com!
```

```
+FTPINFO: 220-
```

```
+FTPINFO: 220 someftpsite.com FTP server (SecureMb FTP Version 1.0) ready.
```

```
+FTPINFO: USER anonymous
```

```
+FTPINFO: 331 Guest login ok, send your complete e-mail address as password.
```

```
+FTPINFO: PASS qwerty@somemail.com
```

```
+FTPINFO: 230 Guest login ok, access restrictions apply.
```

```
+FTPOPEN: 1
```

## +FTPSTAT, Request Status

This command causes the C24 to request the remote FTP server to send status, in accordance with a given parameter.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+FTPSTAT[=<"file/directory name">]	<b>OK</b> ... <b>+FTPSTAT:</b> <result>[,<status>]  <b>or</b>  <b>ERROR: &lt;error_code&gt;</b>	Parameter (optional) consists of directory name as well as directory path (optional).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded <b>2</b> - text message follows  <status> parameter follows only when <result>=2
<b>Read</b>	+FTPSTAT?	<b>ERROR</b>	Not supported
<b>Test</b>	+FTPSTAT=?	<b>+FTPSTAT: (&lt;"file/directory name"&gt;)</b>  <b>OK</b>	Return command format

**Note:** Parameter is optional. When +FTPSTAT command without a parameter is entered, C24 requests the remote side to return a general system status.

The following table shows the +FTPSTAT parameters.

**Table 3-116: +FTPSTAT Parameters**

<Parameter>	Description	Range
<File/directory name>	Name of file or directory on the remote side for status request.	String, max length is 255 octets.

### Example

When the user enters +FTPSTAT command without parameters, the last requested status within actual FTP connection returns. When there is first status request within actual FTP connection, the remote server returns general FTP connection status, like in the following example:

The first example illustrates +FTPSTAT command without parameter first time (for actual FTP connection) use. In this case general FTP connection status returns.

```
AT+FTPSTAT
OK
```

```
+FTPSTAT: 2, SecureMb FTP Version 1.0
+FTPSTAT: 2, Connected to name.provider.com (255.255.255.255)
```

```
+FTPSTAT: 2, Logged in as anonymous
+FTPSTAT: 2, TYPE: ASCII, FORM: Nonprint; STRUcture: File; transfer MODE: Stream
+FTPSTAT: 2, No data connection
+FTPSTAT: 2, 0 data bytes received in 0 files
+FTPSTAT: 2, 0 data bytes transmitted in 0 files
+FTPSTAT: 2, 0 data bytes total in 0 files
+FTPSTAT: 2, 30 traffic bytes received in 0 transfers
+FTPSTAT: 2, 535 traffic bytes transmitted in 0 transfers
+FTPSTAT: 2, 614 traffic bytes total in 0 transfers
+FTPSTAT: 1
```

The second example illustrates using +FTPSTAT command with a parameter containing a name of actually present on remote server file. In this case, the specific file status is returned.

```
AT+FTPSTAT="somefile.name"
OK

+FTPSTAT: 2,-rw-rw-r-- 1 1001 653793 May  2 03:33 somefile.name
+FTPSTAT: 1
```

The third example illustrates using +FTPSTAT command with a parameter containing a name of file, which does not exist on the remote server file. In this case, the remote server returns "No such file or directory" string and command is finished successfully.

```
AT+FTPSTAT="anotherfile.name"
OK

+FTPSTAT: 2,/bin/l: anotherfile.name: No such file or directory
+FTPSTAT: 1
```

The fourth example illustrates using +FTPSTAT command with a parameter containing an illegal file name. In this case, the remote server returns error and FTP connection is closed by the remote side.

```
AT+FTPSTAT="."
OK

+FTPSTAT: 0

+FTPCLOSE: 1
```

The fifth example illustrates using +FTPSTAT command for receiving the status of all files in the actual working directory.

```
AT+FTPSTAT="*.*"
OK

+FTPSTAT: 2,-rw-rw-r-- 1 1001 129886 Mar 23 06:20 somefile1.name
+FTPSTAT: 2,-rw-rw-r-- 1 1001 4968 Jan  8 07:57 somefile2.name
+FTPSTAT: 2,-rw-rw-r-- 1 1001 23948 Jan  8 07:32 somefile3.name
+FTPSTAT: 2,-rw-rw-r-- 1 1001  0 Feb  7 01:56 somefile4.name
+FTPSTAT: 2,-rw-rw-r-- 1 1001 204673 Jan 10 02:28 somefile5.name
+FTPSTAT: 2,-rw-rw-r-- 1 1001  9348 Jul 19 2006 somefile6.name
```

```
+FTPSTAT: 2,-rw-rw-r-- 1 1001 653793 May 2 03:33 somefile7.name
+FTPSTAT: 2,-rw-rw-r-- 1 1001 645120 Mar 25 04:27 somefile8.name
+FTPSTAT: 2,-rw-rw-r-- 1 1001 0 Mar 26 2006 somefile9.name
+FTPSTAT: 1
```

## +FTPSYST, Request Remote FTP Server Operating System Type

This command causes the C24 to request the remote FTP server to send the operating system type.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+FTPSYST</b>	<b>OK</b> ... <b>+FTPSYST:</b> <result>[,<system>]  <b>or</b>  <b>ERROR: &lt;error_code&gt;<sup>3</sup></b>	The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded <b>2</b> - text message follows  <system> parameter follows only when <result>=2
<b>Read</b>	<b>+FTPSYST?</b>	<b>ERROR</b>	Not supported
<b>Test</b>	<b>+FTPSYST=?</b>	<b>ERROR</b>	Not supported

### Example

The example illustrates the command execution.

```
AT+FTPSYST
OK
```

```
+FTPSYST: 2, UNIX Type: L8
+FTPSYST: 1
```

## +FTPNOOP, No Operation

This command causes the C24 to request the remote FTP server to do nothing (possible use for PING).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+FTPNOOP</b>	<b>OK</b> ... <b>+FTPNOOP: &lt;result&gt;</b>  <b>or</b>  <b>ERROR: &lt;error_code&gt;</b>	The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded

Command Type	Syntax	Response/Action	Remarks
<b>Read</b>	<b>+FTPNOOP?</b>	<b>ERROR</b>	Not supported
<b>Test</b>	<b>+FTPNOOP=?</b>	<b>ERROR</b>	Not supported

### Example

The example illustrates the command execution.

```
AT+FTPNOOP
OK
```

```
+FTPNOOP: 1
```

### +FTPCWD, Change Working Directory

This command causes the C24 to request the remote FTP server to change the working directory in accordance to a given name.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+FTPCWD=&lt;"directory_name"&gt;</b>	<b>OK</b>  <b>+FTPCWD: &lt;result&gt;</b>  <b>Or:</b>  <b>ERROR: &lt;error_code&gt;</b>	<b>&lt;directory_name&gt;</b> parameter consists of the directory name as well as the directory path (optional).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded
<b>Read</b>	<b>+FTPCWD?</b>	<b>ERROR</b>	Not supported
<b>Test</b>	<b>+FTPCWD=?</b>	<b>+FTPCWD: (&lt;"directory_name"&gt;)</b>  <b>OK</b>	Returns command format.

The following table shows the +FTPCWD parameters.

**Table 3-117: +FTPCWD Parameters**

<Parameter>	Description	Range
<b>&lt;Directory name&gt;</b>	Name of directory to be changed on the remote side.	String, max length is <b>255</b> octets.

### Example

The first example illustrates change in working directory success case.

```
AT+FTPCWD="data"
OK
```

```
+FTPCWD: 1
```

The second example illustrates change working directory fail case; because the given directory name was not found on the remote server.

```
AT+FTPCWD="user"
OK
```

```
+FTPCWD: 0
```

The third example illustrates change working directory fail case; because no FTP connection was open. The AT+CMEE=2 command enables verbose error report.

```
AT+CMEE=2
OK
```

```
AT+FTPCWD="data"
+CME ERROR: FTP session is inactive
```

### +FTPMKD, Make Directory

This command causes the C24 to request the remote FTP server to create a new directory in accordance to a given name.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+FTPMKD=<"directory_name">	<b>OK</b>  +FTPMKD: <result>  <b>Or:</b>  <b>ERROR: &lt;error_code&gt;</b>	<directory_name> parameter consists of the directory name as well as the directory path (optional).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded
<b>Read</b>	+FTPMKD?	<b>ERROR</b>	Not supported
<b>Test</b>	+FTPMKD=?	+FTPMKD: (<"directory_name">) <b>OK</b>	Returns command format.

The following table shows the +FTPMKD parameters.

**Table 3-118: +FTPMKD Parameters**

<Parameter>	Description	Range
<Directory name>	Name of directory to be created on the remote side.	String, max length is 255 octets.

### Example

The first example illustrates make new directory success case.

```
AT+FTPMKD="somedir"  
OK
```

```
+FTPMKD: 1
```

The second example illustrates make new directory fail case, because the directory name already present on the remote server.

```
AT+FTPMKD="somedir"  
OK
```

```
+FTPMKD: 0
```

### +FTPRMD, Remove Directory

This command causes the C24 to request the remote FTP server to remove a directory in accordance to a given name.

Command Type	Syntax	Response/Action	Remarks
Set	+FTPRMD=<"directory_name">	OK  +FTPRMD: <result>  Or:  ERROR: <error_code>	<directory_name> parameter consists of the directory name as well as the directory path (optional).  The command execution result return to the user as an unsolicited response:  0 - operation failed 1 - operation succeeded
Read	+FTPRMD?	ERROR	Not supported
Test	+FTPRMD=?	+FTPRMD: (<"directory name">) OK	Returns command format.



The following table shows the +FTPRMD parameters.

**Table 3-119: +FTPRMD Parameters**

<Parameter>	Description	Range
<Directory name>	Name of directory to be removed on the remote side.	String, max length is 255 octets.

### Example

The first example illustrates remove directory success case.

```
AT+FTPRMD="somedir"  
OK
```

```
+FTPRMD: 1
```

The second example illustrates remove directory fail case, because the directory name was not found on the remote server. FTP unsolicited indication enabled.

```
AT+FTPINFO=1  
OK
```

```
AT+FTPRMD="somedir"  
OK
```

```
+FTPINFO: RMD 1
```

```
+FTPINFO: 550 1: No such file or directory.
```

```
+FTPRMD: 0
```

## +FTPPWD, Print Working Directory

This command causes C24 to request the remote FTP server to return the working directory name.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+FTPPWD</b>	<b>OK</b> ... <b>+FTPPWD:</b> <result>[,<directory_name>]  <b>or</b>  <b>ERROR: &lt;error_code&gt;</b>	<directory_name> parameter consists of the directory name as well as the directory path (optional).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded <b>2</b> - text message follows  <directory_name> parameter follows only when <result> = 2
<b>Read</b>	<b>+FTPPWD?</b>	<b>ERROR</b>	Not supported
<b>Test</b>	<b>+FTPPWD=?</b>	<b>ERROR</b>	Not supported

### Example

The example illustrates print working directory success case.

AT+FTPPWD  
OK

+FTPPWD: 2, "/home/somedir" is current directory.  
+FTPPWD: 1

## +FTPCDUP, Change Directory Up

This command causes the C24 to request the remote FTP server to change the working directory up.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+FTPCDUP</b>	<b>OK</b> ... <b>+FTPCDUP: &lt;result&gt;</b>  <b>or</b>  <b>ERROR: &lt;error_code&gt;</b>	The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded
<b>Read</b>	<b>+FTPCDUP?</b>	<b>ERROR</b>	Not supported

Command Type	Syntax	Response/Action	Remarks
<b>Test</b>	<b>+FTPCDUP=?</b>	<b>ERROR</b>	Not supported

### Example

The example illustrates change working directory up success case.

```
AT+FTPCDUP
OK
```

```
+FTPCDUP: 1
```

### +FTPDEL, Delete File

This command causes the C24 to request the remote FTP server to delete a file, in accordance to a given name.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+FTPDEL=&lt;"file_name"&gt;</b>	<b>OK</b> ... <b>+FTPDEL: &lt;result&gt;</b>  <b>or</b>  <b>ERROR: &lt;error_code&gt;</b>	<b>&lt;file_name&gt;</b> parameter consists of the file name as well as the file path (optional).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded
<b>Read</b>	<b>+FTPDEL?</b>	<b>ERROR</b>	Not supported
<b>Test</b>	<b>+FTPDEL=?</b>	<b>+FTPDEL: (&lt;"file name"&gt;)</b>  <b>OK</b>	Return command format

The following table shows the +FTPDEL parameters.

**Table 3-120: +FTPDEL Parameters**

<Parameter>	Description	Range
<b>&lt;File name&gt;</b>	Name of file to be deleted on the remote side.	String, max length is <b>255</b> octets.

### Example

The example illustrates delete file success case.

```
AT+FTPDEL="somefile"
OK
+FTPDEL: 1
```

## +FTPLIST, Request List

This command causes the C24 to request the remote FTP server to send a list, in accordance with a given parameter.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+FTPLIST [=&lt;"file/directory name"&gt;]</b>	<b>OK</b> ... <b>+FTPLIST: &lt;result&gt;</b> <list of directory/files> ... <b>+FTPLIST: &lt;result&gt;</b>  <b>or</b>  <b>ERROR: &lt;error_code&gt;</b>	Parameter consists of the file/directory name as well as the file/directory path (optional).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded <b>2</b> - data follows
<b>Read</b>	<b>+FTPLIST?</b>	<b>ERROR</b>	Not supported
<b>Test</b>	<b>+FTPLIST=?</b>	<b>+FTPLIST: (&lt;"file/directory name"&gt;)</b>  <b>OK</b>	Return command format

### Notes:

- Parameter is optional. When +FTPLIST command without a parameter is entered, C24 requests the remote side to return the last requested list.
- The command execution result returns to the user as an unsolicited response (command mode), as well as a list in data mode.
- When +FTPLIST command is executed, a requested list is being sent to the user when C24 is in data mode, immediately after +FTPLIST: 2 unsolicited response, but before +FTPLIST: 1 unsolicited response.

The following table shows the +FTPLIST parameters.

**Table 3-121: +FTPLIST Parameters**

<Parameter>	Description	Range
<b>&lt;File/directory name&gt;</b>	Name of file or directory on the remote side for list request.	String, max length is 255 octets.

### Example

The first example illustrates get list for specific file success case.

```
AT+FTPLIST="somefile.name"
OK
```

```
+FTPLIST: 2
-rw-rw-r-- 1 1001 0 Mar 26 2006 somefile.name
```

+FTPLIST: 1

The second example illustrates get list for all files success case.

AT+FTPLIST="\*,\*"  
OK

+FTPLIST: 2

```
-rw-rw-r-- 1 1001 129886 Mar 23 06:20 somefile1.name
-rw-rw-r-- 1 1001 4968 Jan 8 07:57 somefile2.name
-rw-rw-r-- 1 1001 23948 Jan 8 07:32 somefile3.name
-rw-rw-r-- 1 1001 0 Feb 7 01:56 somefile4.name
-rw-rw-r-- 1 1001 204673 Jan 10 02:28 somefile5.name
-rw-rw-r-- 1 1001 9348 Jul 19 2006 somefile6.name
```

+FTPLIST: 1

## +FTPTYPE, File's Representations Supported

This command represents the file supported by the C24.

Command Type	Syntax	Response/Action	Remarks
Set	+FTPTYPE=<"data_type">	OK ... +FTPTYPE: <status>  or  ERROR: <error_code>	
Read	+FTPTYPE?	+FTPTYPE: <data_type> OK	
Test	+FTPTYPE=?	+FTPTYPE: (range of supported <data_type>s)	

The following table shows the +FTPTYPE parameters.

**Table 3-122: +FTPTYPE Parameters**

<Parameter>	Description
<data_type>	0 - ASCII Non-print type 1 - Image (binary) type - Default

## +FTPSTOR, Store File On Remote FTP Server

This command causes the C24 to request the remote FTP server to store a file sent by the C24.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+FTPSTOR=<"file_name">, [<file_type>]	OK ... +FTPSTOR: <result>  or  ERROR: <error_code>	<file_name> parameter consists of the file name as well as the file path (optional).  <file_type> parameter is optional. Default value is <b>1</b> (binary).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded <b>2</b> - data connection (ODM) enabled
<b>Read</b>	+FTPSTOR?	ERROR	Not supported
<b>Test</b>	+FTPSTOR=?	+FTPSTOR: (<"file name">)[,(0-1)]  OK	Return command format

### Notes:

The user can send a file to the C24 only when the C24 returns <result> = 2. In this case, the C24 switches to Online Data Mode and all data sent to RS232 transfers as-is to the remote server.

**Important:** Before transferring to the remote side, data file is converted (encoded), see “FTP Connection” on page 1-8. When end-of-file is reached, C24 switches back to Command Mode and return <result> = 1 (success case).

In any stage of file transfer, an error can occur. In this case, C24 switches to Command Mode and <result> = 0 is returned to the user.

The following table shows the +FTPSTOR parameters.

**Table 3-123: +FTPSTOR Parameters**

<Parameter>	Description	Range
<file_name>	Name of file to be stored on the remote side.	String, max length is <b>255</b> octets.
<file_type>	Type of file (ASCII or Binary).	Numeric, in the range of <b>0-1</b> (0 = ASCII, 1 = Binary).

### Example

The example illustrates the command execution. Requested file type is binary.

```
AT+FTPSTOR="somefile.name",1
```

```
+FTPSTOR: 2
```

The user sends a file with <end-of-file> here

```
+FTPSTOR: 1
```

### +FTPRETR, Retrieve a File From a Remote FTP Server

This command causes the C24 to request the remote FTP server to send a file to the C24.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+FTPRETR=<"file_name">, [<file_type>]	OK ... +FTPRETR: <result>  or  ERROR: <error_code>	<file_name> parameter consists of the file name as well as the file path (optional).  <file_type> parameter is optional. Default value is <b>1</b> (binary).  The command execution result return to the user as an unsolicited response:  <b>0</b> - operation failed <b>1</b> - operation succeeded <b>2</b> - data connection (ODM) enabled
<b>Read</b>	+FTPRETR?	<b>ERROR</b>	Not supported
<b>Test</b>	+FTPRETR=?	+FTPRETR: (<"file name">)[,<0-1>]  OK	Return command format

#### Notes:

The user can store a file, received from C24, immediately after C24 returns <result> = 2. In this case C24 switches to Online Data Mode and all data, received from the RS232 is the requested file.

**Important:** The user converts (decode) the received data file for end-of-file detect, see [“FTP Connection” on page 1-8](#). When the remote FTP server closes data connection, C24 switches back to Command Mode and returns <result> parameter = 1 (success case).

In any stage of file transfer, an error can occurred. In this case, C24 switches to Command Mode and <result> = 0 is returned to the user.

The following table shows the +FTPRETR parameters.

**Table 3-124: +FTPRETR Parameters**

<Parameter>	Description	Range
<file_name	Name of file to be retrieved from the remote side.	String, max length is 255 octets.
<file_type>	Type of file (ASCII or Binary).	Numeric, in the range of 0-1 (0 = ASCII, 1 = Binary).

### Example

The example illustrates the command execution. Requested file type is binary.

```
AT+FTPRETR="somefile.name",1
```

```
+FTPRETR: 2
```

```
....
```

```
....
```

```
....
```

```
<ETX>
```

```
+FTPRETR: 1
```

### +FTPREN, Rename File

This command causes the C24 to request the remote FTP server to rename a file, in accordance with a given parameters.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+FTPREN=<"file_name_from">,<"file_name_to">	OK ... +FTPREN: <result>  or  ERROR: <error_code>	<file_name_from> and <file_name_to> parameters consists of the file name as well as the file path (optional).  The command execution result return to the user as an unsolicited response:  0 - operation failed 1 - operation succeeded
<b>Read</b>	+FTPREN?	ERROR	Not supported
<b>Test</b>	+FTPREN=?	+FTPREN: (<"file name from">), (<"file name to">)  OK	Return command format



The following table shows the +FTPREN parameters.

**Table 3-125: +FTPREN Parameters**

<Parameter>	Description	Range
<file_name_from>	<b>Old</b> name of file to be renamed on the remote side.	String, max length is <b>255</b> octets.
<file_name_to>	<b>New</b> name of file to be renamed on the remote side.	String, max length is <b>255</b> octets.

### Example

The first example illustrates rename file success case.

```
AT+FTPREN="somefile.name","anotherfile.name"  
OK
```

```
+FTPREN: 1
```

The second example illustrates rename file fail case, because the file name was not found on the remote server. FTP unsolicited indication enabled.

```
AT+FTPINF=1  
OK
```

```
AT+FTPREN=" somefile.name","anotherfile.name"  
OK
```

```
+FTPINF: RNFR somefile.name
```

```
+FTPINF: 550 somefile.name: No such file or directory.
```

```
+FTPREN: 0
```

## Modem Configuration and Profile

### Modem Register Commands

The C24 holds certain data items in selected memory space, named Software Registers (S-registers) and Modem Registers. Some of these registers are used as bitmaps, where one register holds more than one data item.

All S-registers can be accessed using the S command, described in “S, Bit Map Registers” on page 3-216. Some registers can also be accessed using dedicated commands, detailed below.

### V, C24 Response Format

This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses. This command also determines whether the result codes are transmitted in a numeric or an alphabetic ("verbose") form. The text portion of information responses is not affected by this setting.

The following table shows the effect that setting this parameter has on the format of information text and result codes.

**Table 3-126: Effects of Parameter Settings**

	V0	V1	Information Responses
Information responses	<text><cr><lf>	<cr><lf><text><cr><lf>	0 - "OK" 1 - "CONNECT" 2 - "RING" 3 - "NO CARRIER" 4 - "ERROR" 5 - "NO DIALTONE" 6 - "BUSY" 7 - "NO ANSWER"
Result codes	<numeric code><cr>	<cr><lf><verbose code><cr><lf>	

Command Type	Syntax	Response/Action	Remarks
Set	ATV<value>	OK or: +CME ERROR: <err>	The Set command sets the format of information responses and result codes. In case ATV is set without value it will set the default value.
Read	ATV?	<current value>	The Read command reads the current setting of response format.
Test			The Test command for V is not defined, and therefore is not supported by the C24. The C24 returns an error.

The following table shows the V parameters.

**Table 3-127: V Parameters**

<Parameter>	Description
<value>	0      Transmits limited headers and trailers, and numeric text. 1      Transmits full headers and trailers, and verbose response text. The default value is 1.

### Example

```

ATV?
V: 1
OK
ATV0
0
ATV7
4
ATV1
OK
ATV7
ERROR

```

### Q, Result Code Suppression

This command determines whether to output the result codes. Information text transmitted in response to commands is not affected by the setting of this parameter.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATQ<value>	OK or: +CME ERROR: <err>	The set commands sets whether or not to output result codes. In case ATQ is set without value it will set the default value.
<b>Read</b>	ATQ?	<current value>	The Read command reads the current setting for result code suppression.
<b>Test</b>			The Test command for Q is not defined, and therefore is not supported by the C24. The C24 returns an error.

The following table shows the Qn parameters.

**Table 3-128: Qn Parameters**

<Parameter>	Description
<value>	0 Transmit result codes. 1 Suppress result codes. The default value is 0.

#### Example

```
ATQ0
OK
ATQ?
Q: 0
OK
ATQ4
ERROR
ATQ1 //No response because result codes are suppressed.
ATQ4 //No response because result codes are suppressed.
```

## E, Command Echo

This command defines whether input characters are echoed to output. If so, these characters are echoed at the same rate, parity and format at which they were received.

Command Type	Syntax	Response/Action	Remarks
Set	ATE<value>	OK or: +CME ERROR: <err>	The Set command sets whether or not to echo characters. In case ATE is set without value it will set the default value.
Read	ATE?	<current value>	The Read command reads the current setting for command echo.
Test			The Test command for E is not defined by ITU, and therefore is not supported by the C24. The C24 returns an error.

The following table shows the E parameters.

**Table 3-129: En Parameters**

<Parameter>	Description
<value>	0 Does not echo characters 1 Echoes characters The default value is 0.

**Example**

```

ATE?
E: 1
OK

```

**X, Result Code Selection and Call Progress Monitoring Control**

This command defines the CONNECT result code format. It determines whether or not the C24 transmits particular result codes to the user. It also controls whether the C24 verifies the presence of dial tone when it first goes off-hook to begin dialing, and whether the engaged tone (busy signal) detection is enabled.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATX<value>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the result code and call progress monitoring control. In case ATX is set without value it will set the default value.
<b>Read</b>	ATX?	<current value>	
<b>Test</b>			The Test command for X is not defined by ITU, and therefore is not supported by the C24. The C24 returns an error.

The following table shows the X parameters.

**Table 3-130: X Parameters**

<Parameter>	Description
<value>	<p>0     CONNECT result code given upon entering online data state: Dial tone detection - Disabled Busy detection - Disabled</p> <p>1     CONNECT &lt;text&gt; result code given upon entering online data state: Dial tone detection - Disabled Busy detection - Disabled</p> <p>2     Value should be supported but has the same behavior as 1.</p> <p>3     Value should be supported but has the same behavior as 1.</p> <p>4     Value should be supported but has the same behavior as 1.</p> <p>The default value is 0.</p> <p><b>Note:</b> In case of cellular (wireless) network the dial and busy tone detection seems as not relevant, so the X1; X2; X3 and X4 should work as X1.</p>

**Example**

```

ATX?
X: 0
OK

```

**Note:**

1. If ATX0 and CSD call, the "CONNECT" message will be thrown in case of successfully connect.
2. If ATX1 (or ATX2 or 3 or 4) and CSD call, the "CONNECT 9600" message will be thrown in case of successfully connect at 9600 bps. or "CONNECT 14400" will be thrown in case of successfully connect at 14400 bps.  
Please note that this is CARRIER (the air) baud rate and not a RS232 baud rate.

## S, Bit Map Registers

This command reads/writes values of the S-registers. The C24 supports this command for various S values, according to official specifications (ITU-I, ETSI, or manufacturer specific).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATSn=<value>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command is allowed for read/write S-registers, and not allowed for read-only S-registers.
<b>Read</b>	ATSn?	<current value of S-register n> or: <b>+CME ERROR: &lt;err&gt;</b>	
<b>Test</b>			The Test command for Sn is not defined by ITU, and therefore is not supported by the C24. The C24 returns an error.

The following table shows the different S-registers and their associated values.

Sn	Description	Min Value	Max Value	Default Value
<b>S0</b>	Sets/gets number of rings before auto answer.	0	255	0
<b>S2</b>	Sets/gets escape code character.	0	255	43
<b>S3</b>	Sets/gets carriage return code character.	0	127	13
<b>S4</b>	Sets/gets line feed code character.	0	127	10
<b>S5</b>	Sets/gets command line editing character (backspace).	0	127	8
<b>S7</b>	Waiting time in seconds before carrier detects the time to wait for a carrier from the remote modem before hanging up.	1	255	50
<b>S8</b>	Pause Time In seconds For Dial Delay - Controls how long the modem pauses when a comma "," is encountered in a dial string while executing a dial command.	0	255	2
<b>S12</b>	Sets/gets guard time (in units of 50 msec) for the escape character during CSD connections.  <b>Note:</b> For a guard time specified by S-Register 12, no character should be entered before or after "+++". The duration between escape codes must be smaller than the guard time.	0	255	20

**Note:** S0 (Auto Answer) should work regardless of the DTR HW line state. This is a deviation from the ITU V. 25-ter standard.

## S2

This command handles the selection of the escape characters, which are stored in S-Register 2, and specifies the escape character used in CSD connections.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	S2=<escape_character>	<b>OK</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the CSD escape character value if all parameters are valid.
<b>Read</b>	S2?	<escape_character> <b>OK</b> <b>+CME ERROR: &lt;err&gt;</b>	The Read command displays the currently defined escape character for CSD connections.

The following table shows the S2 parameters.

**Table 3-131: S2 Parameters**

<Parameter>	Description
<escape_character>	CSD escape character. Range is 0 to 255. The default value is 43 ("+").

## \S, Show the Status of the Commands and S-registers in Effect

This command displays the status of selected commands and S-registers.

## ?, Return the Value of the Last Updated S-register

This command displays the most recently updated value stored in an S-register.

Command Type	Syntax	Response/Action	Remarks
<b>Read</b>	AT?	<b>000</b> <b>OK</b>	The Read command returns the value of the last updated S-register.

### Example

```
AT?
000
OK
AT?
003
OK
ATS36=5
OK
```



AT?  
005  
OK

## &F, Set to Factory Defined Configuration

This command restores the factory default configuration profile. The C24 only supports one factory default profile, 0.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT&F<value>	OK or: +CMS ERROR: <err>	
<b>Read</b>	AT&F?	<current profile number>	
<b>Test</b>			The Test command for &F is not defined by ITU, and therefore is not supported by the C24. The C24 returns an error.

The following table shows the &F parameters.

**Table 3-132: &F Parameters**

<Parameter>	Description
<value>	0      Factory default configuration profile. This is the only value supported.

### Example

AT&F?  
&F: 0  
OK

## Z, Reset to Default Configuration

This command drops the current call, and resets the values to default configuration.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATZ<value>	<b>OK</b> or: <b>+CMS ERROR: &lt;err&gt;</b>	In case ATZ is set without value, the default value will be set.
<b>Read</b>			The Read command for Z is not defined, and therefore is not supported by the C24. The C24 returns an error.
<b>Test</b>			The Test command for Z is not defined, and therefore is not supported by the C24. The C24 returns an error.

The following table shows the Z parameters.

**Table 3-133: Z Parameters**

<Parameter>	Description
<value>	0     Set to user profile 0 1     Set to user profile 1 The default value is 0.

### Example

```
ATZ0
OK
```

## &V, View Configuration

Command Type	Syntax	Response/Action	Remarks
<b>Execute</b>	<b>&amp;V</b>	<b>ACTIVE PROFILE:</b> ... (profile data) <b>STORED PROFILE 0:</b> ... (profile data) <b>STORED PROFILE1:</b> ... (profile data) <b>OK</b> or <b>+CME ERROR: &lt;err&gt;</b>	The Execute command displays the current active configuration and stored user profiles.

### Example

```

at&v
ACTIVE PROFILE:
E1 Q0 V1 X4 &C1 &D2 &K3 &Y0
S00:000 S01:000 S02:043 S03:013 S04:010 S05:008 S06:004 S07:050
S08:004 S09:006 S10:014 S12:040 S14:AAH S16:80H S18:000 S21:30H
S22:F6H S23:1BH S25:005 S26:001 S27:09H
STORED PROFILE 0:
E1 Q0 V1 X4 &C1 &D2 &K3
S00:000 S02:043 S03:013 S04:010 S05:008 S07:050 S12:040
STORED PROFILE 1:
E1 Q0 V1 X4 &C1 &D2 &K3
S00:000 S02:043 S03:013 S04:010 S05:008 S07:050 S12:040
OK

```

## &W, Store User Profile

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>&amp;W[&lt;n&gt;]</b>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command stores the current active configuration to user profile 0 or 1.

The following table shows the &W parameters.

**Table 3-134: &W Parameters**

<Parameter>	Description
<n>	User's profile number: 0 Store to user's profile 0 1 Store to user's profile 1 The default value is 0.

The parameters that are set in a profile are described in the table below.

**Table 3-135: Profile Parameters**

Profile Parameter	Description	Parameter Range	Default Value	Length in Bits
<b>ATE</b>	Echo	0-1	1	1
<b>ATQ</b>	Result code return mode	0-1	0	1
<b>ATV</b>	Display result code	0-1	1	1
<b>ATX</b>	Select result code	0-4	0	3
<b>AT&amp;C</b>	Set circuit 109 (DCD) behavior	0-2	1	2
<b>AT&amp;D</b>	Set circuit 109 (DTR) behavior	0-4	2	3
<b>AT&amp;K</b>	Flow control	0, 3-6	3	3
<b>AT&amp;Y</b>	Power-up profile	0-1	0	1
<b>S0</b>	Auto-answer	0-255	0	8
<b>S2</b>	Escape code character	0-255	43	8
<b>S3</b>	Carriage return character	0-127	13	7
<b>S4</b>	Line feed character	0-127	10	7
<b>S5</b>	Backspace character	0-32	8	6
<b>S7</b>	Waiting time in seconds before carrier detects the time to wait for a carrier from the remote modem before hanging up.	1-255	50	8
<b>S8</b>	Pause Time In seconds For Dial Delay - Controls how long the modem pauses when a comma "," is encountered in a dial string while executing a dial command.	0-255	2	8
<b>S12</b>	Sets/gets guard time (in units of 50 msec) for the escape character during CSD connections.  <b>Note:</b> For a guard time specified by S-Register 12, no character should be entered before or after "+++". The duration between escape codes must be smaller than the guard time..	0-255	20	8

**Example**

```

AT&W0
OK
AT&W1
OK

```

**&Y, Default User Profile**

Command Type	Syntax	Response/Action
Set	&Y<n>	OK or: +CME ERROR: <err>

The following table shows the &Y parameters.

**Table 3-136: &Y Parameters**

<Parameter>	Description
<n>	User's profile number: 0      Selects power-up configuration to user's profile 0 1      Selects power-up configuration to user's profile 1 The default value is 0.

**Example**

```

AT&Y0
OK
AT&Y1
OK

```

**Sleep Mode Commands**

When the C24 is connected using RS232 connection to external device, a sleep mechanism is available. In order to improve the power consumption, the C24 supports a low-power consumption mode, called "Sleep mode". The C24 has internal decision conditions for entering and exiting sleep mode. As the terminal and the C24 operate in a combined system, and as the communication between the C24 and the terminal must be reliable, there should be a mechanism agreed upon by both the C24 and the terminal to co-ordinate their separate sleep mode entering and exiting sequences. The C24 will not enter sleep mode unless the terminal enables the C24

sleep mode and signals its readiness for sleep. For this purpose, a set of AT commands and dedicated HW lines are defined.

**Note:** The Sleep mode feature is not relevant when using USB. In USB mode the C24 is always awake. While USB is connected, do not use the following:

1. Sleep mode AT commands.
2. Sleep mode dedicated HW line (wake in/wake out).

### Sleep Mode AT Commands

The following are the Sleep mode AT commands:

- **ATS24:** Activates/deactivates Sleep mode.  
The C24 receives a request to activate or deactivate Sleep mode.
- **ATS102:** Sets the value of the delay before sending data to the terminal.  
The C24 receives the value that defines the period to wait between sending the wake-up signal, and sending data to the terminal.
- **ATS100:** The minimum time that takes the Terminal to enter sleep mode. Only if this time period passes, the C24 will wait ATS102 time between wake-up out line and data transmission.
- **AT+MSCTS:** The UART's CTS line control.  
The C24 receives a request to define the behavior of the CTS line when the C24 is in Sleep mode. It enables or disables activation of the CTS line after wakeup.

### Sleep Mode HW Signals

Two HW lines are used:

- One for waking the C24 (Wakeup-In)
- One for waking the terminal (Wakeup-Out)

### Terminal Does Not Wake the C24 (If the Terminal Uses Hardware Flow Control Only)

When the C24 is in Sleep mode, the CTS line is also inactive. The terminal does not send any characters to the C24 if the CTS is inactive, otherwise the character may be lost (Hardware Flow Control).

### Terminal Wakes the C24 Using the Wakeup-In Line

The terminal uses the Wakeup-In line (pin #16) to wake up the C24 when it wants to send data. When the Wakeup-In line is low, the C24 will not enter the Sleep mode. If the terminal has data to send while the C24 is sleeping, it activates the line (brings it to active low), then waits 5 ms (the time required to wake the C24). Only then can the terminal start sending data.

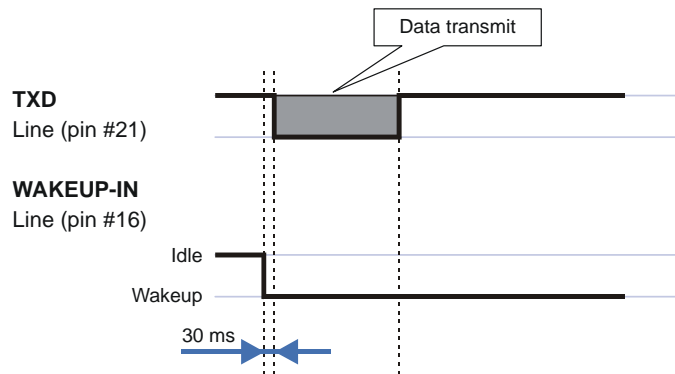


Figure 3-4: Wakeup-In Line

Two modes exist:

- Idle Mode: The terminal has no data to send. If the terminal enables sleep mode (using `ats24`), the C24 activates its Sleep mode module.
- Wakeup Mode: The C24 does not enter sleep mode, and the terminal can send data.

Once the terminal changes the line edge to Wakeup mode, it needs a 5 ms delay before sending any data to the C24 (using the RS232 protocol).

### C24 Wakes the Terminal

The C24 follows these steps in order to wake up the terminal:

- The C24 indicates to the terminal that it has data and that it must wake up. The C24 uses the Wakeup-Out Line (pin #26) (brings it to active low).
- While the Wakeup Out line is low, the terminal should not enter Sleep mode.
- The terminal should set a value of the delay (in ms) needed for waking it (using the `ATS102` command) before receiving data (default value is 30 ms).

When the data transmission is complete, the C24 gets the output wakeup line to high.

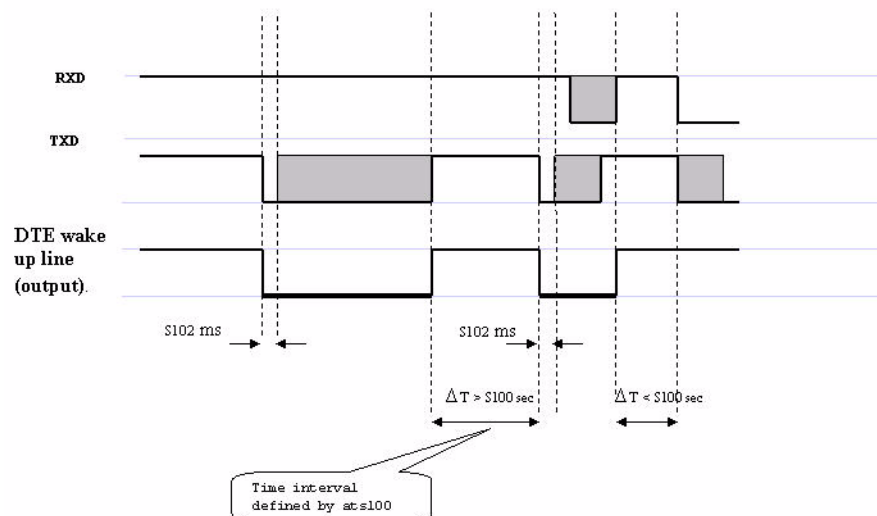


Figure 3-5: Wake up Outline

Two modes exist:

- Idle mode: The C24 has no data to send.
- Wakeup mode: The C24 has data to send to the terminal.

After the C24 changes the line edge to Wakeup mode, there will be a delay (the default is 30 ms) sent by the ATS102 command before sending any data to the terminal (using RS232 protocol).

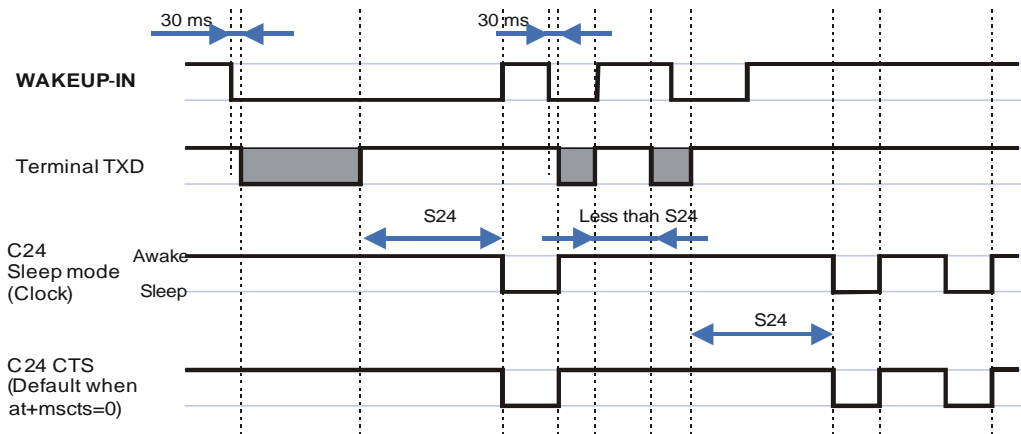


Figure 3-6: Sleep Mode when S24 > 0

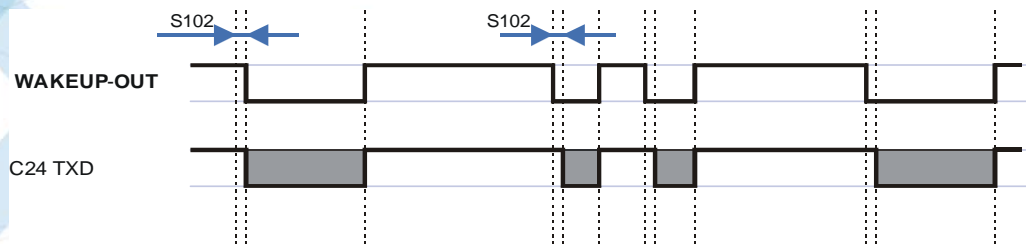


Figure 3-7: C24 Lines when S24 > 0

## S24, Set Number of Seconds Delay Before C24 Enters Sleep Mode

This command activates/disables the Sleep mode. The terminal sends ATS24=5, and if there are no radio and UART activities, the C24 enters sleep mode in 5 seconds.

If terminal has some indication of the CTS pin activity, it can see:

- If +MSCTS=0 (default), the line changes its state periodically. (For more information refer to [“+MSCTS, Enable/Disable CTS During Wakeup Period”](#) on page 3-229.)
- If +MSCTS=1, the line is switched off at the moment of entering Sleep mode and stays off even if C24 is awakened.



Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATS24=[<value>]	OK	The Set command sets the amount of time, in seconds, the C24 should wait before entering Sleep mode.
<b>Read</b>	ATS24?	<value> OK	The Read command returns the current value.

The following table shows the S24 parameters.

**Table 3-137: S24 Parameters**

<Parameter>	Description
<value>	Number of seconds (0 ≤ n ≤ 255) 0      Disable Sleep mode >0    Enable Sleep mode The default value is 0.

#### Example

```
ATS24? <enter>
000
OK
ATS24=5 <enter>
OK
ATS24? <enter>
005
OK
```

(If there are no radio and UART activities, the C24 will enter sleep mode in 5 seconds)

### S102, Set Delay Before Sending Data to the Terminal

This command sets the value of the delay before sending data to the terminal. Before receiving data, the terminal connected to the C24 will receive:

- Terminal Wakeup signal (the Wakeup Out Line (pin #26) state will be active low).
- A delay that is equal ATS102 value.
- Data (HSPD, CD, AT commands' results, unsolicited reports).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATS102 = <value>	OK	The Set command sets the delay before sending data to the terminal, and defines a period between sending the wakeup signal and sending data to the terminal.
<b>Read</b>	ATS102?	<value> OK	The Read command returns the current value.

The following table shows the S102 parameters.

**Table 3-138: S102 Parameters**

<Parameter>	Description
<value>	0 <= value <= 255 The default value is 30 ms.

### Example

```

ATS102? <enter>
030
OK
ATS102=100 <enter>
OK
ATS102? <enter>
100
OK

```

(This means if there is data for transmission to the terminal, the C24 drops the Wakeup Out line, waits 100 ms. and then sends data to the terminal.)

## S100, Set Minimum Time for Terminal to Fall into Sleep Mode

ATS100 is a terminal minimum time limit for entering sleep mode.

In order to limit the number of interrupts on the DTE side and reduce data sending delay time on our side, C24 sends wakeup-out pulse when the interval between one burst of sent/received data to the other is bigger than specified in ATS100.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATS100=<delta>	OK Or +CME ERROR: <err>	The set command sets the terminal minimum time limit for entering sleep mode.
<b>Read</b>	ATS100?	<delta> OK	The Read command returns the current ATS100 value.

**Table 3-139: S100 Parameters**

<Parameter>	Description
<delta>	Time interval between one burst of sent/received data to the other before the terminal enters sleep mode. 0: Wakeup out feature isn't active. (default at power up) 1 - 255: Time in seconds.

**Example**

```

ATS100?
001
OK
ATS100=0
OK
ATS100?
000
OK

```

**+MSCTS, Enable/Disable CTS During Wakeup Period**

This command defines the behavior of the CTS line when the C24 is in normal mode (not Sleep mode).

The command configures the C24 CTS line behavior always to follow the flow control requirements, or to follow it only if the terminal initiated a serial transmission session. This saves the terminal from following the CTS interrupt every time the C24 exits Sleep mode for internal C24 reasons (non-terminal communication related reasons).

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MSCTS=<control>	<b>OK</b>	The Set command tells the C24 whether to activate the CTS when the unit is awakening.
<b>Read</b>	AT+MSCTS?	+MSCTS: <current control> <b>OK</b>	The Read command returns the current control value.
<b>Test</b>	AT+MSCTS=?	+MSCTS: (list of supported <control>) <b>OK</b>	The Test command returns the possible control values.

The following table shows the +MSCTS parameters.

**Table 3-140: +MSCTS Parameters**

<Parameter>	Description
<control>	0      In Normal Mode: The CTS is used for Flow Control In Sleep mode: The CTS is inactive. 1      Wakeup In line is Active: The CTS is used for Flow Control. Wakeup In line is Inactive: The CTS is inactive. The default value is 0.

**Example**

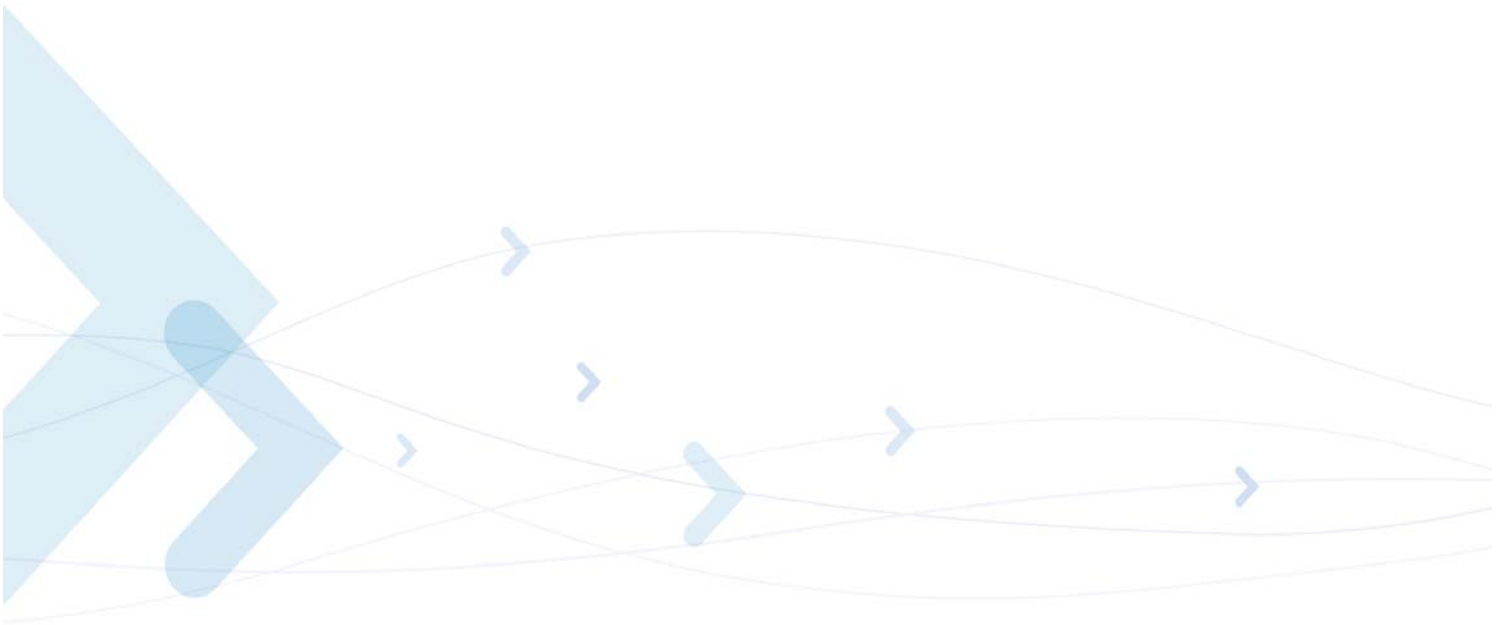
```

AT+MSCTS=?
+MSCTS: (0-1)

```

```
OK
AT+MSCTS?
+MSCTS: 0
OK
AT+MSCTS = 1
OK
ATS102?
1
OK
```

**Note:** This means that by waking up, the CTS line will stay OFF and it can be activated by the Wakeup IN Line interrupt only.



## NAM Programming

### +MNAME, Set Get NAM Parameters

This command gets or sets the NAM parameters (parameters 1-8 out of 31).

**Notes:**

- C24 will perform power cycle after set command executed in order to make changes active.
- SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MNAME= < > , < Option Byte 1 > ,< Mobile Identification Number (MIN) >,< Mobile Directory Number (MDN) >,< > ,< Access Overload Code (ACCOLC) >,<Option Byte 2 >,< Option Byte 3>,<home sid>,<for sid>,<for nid>,<akey>	<b>OK</b> <b>Or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the C24 NAM parameter.  <b>Notes:</b> <ol style="list-style-type: none"> <li>1. AMPS, SCM can't be set. Please set an empty values instead.</li> <li>2. In R-RUIM model the MIN, MDN and ACCOLC are not settable - response for setting these parameters will return "operation not allowed".</li> </ol>
<b>Read</b>	AT+MNAME?	+MNAME: < AMPS (Analog) HOME_SID >, < Option Byte 1 >, < Mobile Identification Number (MIN) >, < Mobile Directory Number (MDN) >, < Station Class Mark (SCM)>, < Access Overload Code (ACCOLC) >, < Option Byte 2 >, < Option Byte 3>, <home sid>, <for sid>, <for nid> <b>OK</b>	The read command returns the current NAM values.

The following table shows the +MNAM parameters.

**Table 3-141: +MNAM Parameters**

<Parameter>	Description	Remarks
<AMPS (Analog) HOME_SID>	0-32767 AMPS (Analog) HOME_SID	
<Option Byte 1>	0-255 Option Byte 1	
<Mobile Identification Number (MIN)>	0-10 Mobile Identification Number (MIN)	Number of digits. <b>Note:</b> Unable to set in R-UIM model.
<Mobile Directory Number (MDN)>	0-10 Mobile Directory Number (MDN)	Number of digits. <b>Note:</b> Unable to set in R-UIM model.
<Station Class Mark (SCM)>	0-255 Station Class Mark (SCM)	Mutual Field for All NAMs.
<Access Overload Code (ACCOLC)>	0-15 Access Overload Code (ACCOLC)	<b>Note:</b> unable to set in R-UIM model.
<Option Byte 2>	0-255 Option Byte 2	Mutual Field for All NAMs.
<Option Byte 3>	0-255 Option Byte 3	Mutual Field for All NAMs.
<home sid>	0 - disable 1 - enable	
<for sid>	0 - disable 1 - enable	
<for nid>	0 - disable 1 - enable	
<akey>	26 digits authentication key	Writable, not readable.

## +MNAM2, Set Get NAM Parameters

This command gets or sets the NAM parameters (parameters 9-18 out of 31).

- Notes:**
- C24 will perform power cycle after set command executed in order to make changes active.
  - SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MNAM2=< AMPS initial paging channel> , < AMPS First Dedicated Channel System A> ,< AMPS First Dedicated Channel System B>,< AMPS Number Of Channels To scan>,< Option Byte 4>,< Option Byte 5>,< Slot cycle index (SCI)>,< System ID (SID) >,< Network ID (NID)>,< Mobile country code (MCC)>	<b>OK</b> <b>Or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the C24 NAM parameter.  In R-RUIM model the SID, NID and MCC are not settable - response for setting these parameters will return "operation not allowed".
<b>Read</b>	AT+MNAM2?	<b>+MNAM2:</b> <b>&lt; AMPS initial paging channel&gt;</b> , <b>&lt; AMPS First Dedicated Channel System A&gt;</b> , <b>&lt; AMPS First Dedicated Channel System B&gt;</b> , <b>&lt; AMPS Number Of Channels To scan&gt;</b> , <b>&lt; Option Byte 4&gt;</b> , <b>&lt; Option Byte 5&gt;</b> , <b>&lt; Slot cycle index (SCI)&gt;</b> , <b>&lt; System ID (SID) &gt;</b> , <b>&lt; Network ID (NID)&gt;</b> , <b>&lt; Mobile country code (MCC)&gt;</b> , <b>OK</b>	The read command returns the current NAM values.

The following table shows the +MNAME2 parameters.

**Table 3-142: +MNAME2 Parameters**

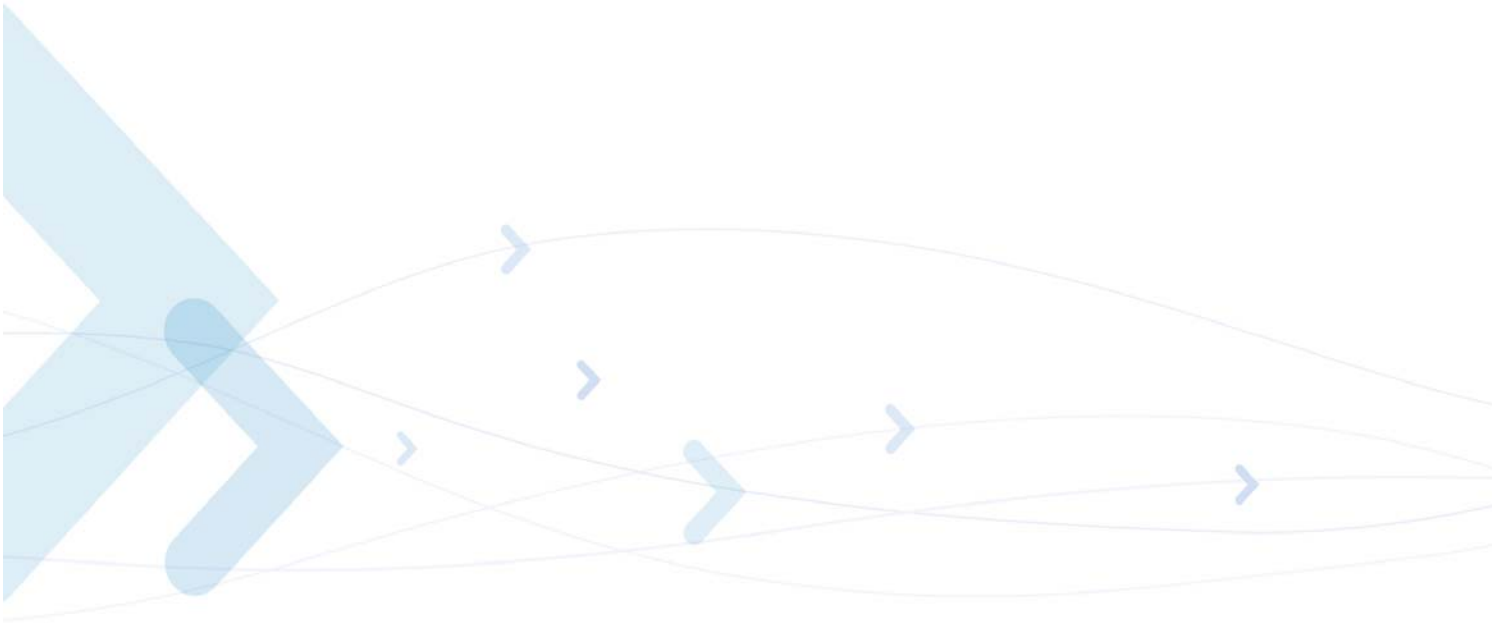
<Parameter>	Description	Remarks
<AMPS initial paging channel>	0-1023 AMPS initial paging channel	
<AMPS First Dedicated Channel System A>	0-9999 AMPS First Dedicated Channel System A	Mutual Field for All NAMs.
<AMPS First Dedicated Channel System B>	0-9999 AMPS First Dedicated Channel System B	Mutual Field for All NAMs.
<AMPS Number Of Channels To scan>	0-9999 AMPS Number Of Channels To scan	Mutual Field for All NAMs.
<Option Byte 4>	0-255 Option Byte 4	Mutual Field for All NAMs.
<Option Byte 5>	0-255 Option Byte 5	
<Slot cycle index (SCI)>	0-7 Slot cycle index (SCI)	Mutual Field for All NAMs.
<System ID (SID)>	0-32767 System ID (SID)	<b>Note:</b> Unable to set in R-UIM model.
<Network ID (NID)>	0-65535 Network ID (NID)	<b>Note:</b> Unable to set in R-UIM model.
<Mobile country code (MCC)>	000-999 Mobile country code (MCC)	<b>Note:</b> Unable to set in R-UIM model.



### **+MNAM3, Set Get NAM Parameters**

This command gets or sets the NAM parameters (parameters 19-31 out of 31).

- Notes:**
- C24 will perform power cycle after set command executed in order to make changes active.
  - SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.



Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MNAM3=<imsi 11 12>, <System mode >, <vocoder type >, <true imsi address number >, <true imsi status >, <true imsi programmed/deprogrammed >, <true imsi mobile identification number>, <true imsi mobile country number>, <true imsi 1112>, <cdma primary channel system A >, <cdma primary channel system B >, <cdma secondary channel system A >, <cdma secondary channel system B >	OK Or: +CME ERROR: <err>	The Set command sets the C24 NAM parameter.  In R-RUIM model the <imsi 11 12>, <true imsi MIN>,<true imsi 11 12> and <true imsi MCC>are not settable - response for setting these parameters will return "operation not allowed".
<b>Read</b>	AT+MNAM3?	+MNAM3: <imsi 11 12>, <System mode >, <vocoder type >, <true imsi address number >, <true imsi status >, <true imsi programmed/deprogrammed >, <true imsi mobile identification number >, <true imsi mobile country number >, <true imsi 11 12>, <cdma primary channel system A >, <cdma primary channel system B >, <cdma secondary channel system A >, <cdma secondary channel system B >, OK	The read command returns the current NAM values.

The following table shows the +MNAM3 parameters.

**Table 3-143: +MNAM3 Parameters**

<Parameter>	Description	Remarks
<imsi 11 12>	00-99 imsi 11 12 (MNC - Mobile Network Code)	<b>Note:</b> Unable to set in R-UIM model.
<System mode>	0 - A only 1 - A then B 2 - B only 3 - B then A 4 - Home SID only 5 - Home SID preferred	
<vocoder type>	0 - 13K 1 - EVRC 2 - EVRC-B	
<true imsi address number >	0-111 true imsi address number	
<true imsi status>	0-1 true imsi status - refer to class 0 or class 1 TRUE IMSI	
<true imsi programmed/deprogrammed>	1- Programmed 0- Deprogrammed true imsi programmed/deprogrammed	
<true imsi mobile identification number>	0000000000-9999999999 true imsi mobile identification number	<b>Note:</b> Unable to set in R-UIM model.
<true imsi mobile country number >	000-999 true imsi mobile country number	<b>Note:</b> Unable to set in R-UIM model.
<true imsi 11 12>	00-99 true imsi 11 12	<b>Note:</b> Unable to set in R-UIM model.
<cdma primary channel system A>	0000-1023 cdma primary channel system A	
<cdma primary channel system B>	0000-1023 cdma primary channel system B	
<cdma secondary channel system A>	0000-1023 cdma secondary channel system A	
<cdma secondary channel system B>	0000-1023 cdma secondary channel system B	

**Notes:**

- If parameter <true imsi programmed/deprogrammed > is set to '0', then True IMSI will be deprogrammed ("true imsi mobile identification number" will be set with the four least-significant digits set to ESN p and converted directly from binary to decimal, modulo 10000, "true imsi mobile country number" will be set to '0'," true imsi 11 12" will be set to zero).
- In order to program the True imsi,< true imsi programmed/deprogrammed > must be set to 1 (see IS683A, page 3-1 paragraph 20).

**+SNAM, Selects/Reads the Current Active NAM**

This command Selects/reads the current active NAM to which the NAM data will be written/retrieved using AT+MNAME [x].

**Note:** SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+SNAM=<active nam>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The set commands set the active NAM.
<b>Read</b>	AT+SNAM?	<b>+SNAM: &lt;active nam&gt;</b> <b>OK</b>	The Read command returns the current active NAM value.
<b>Test</b>	AT+SNAM=?	<b>+SNAM: (list of supported &lt;active nam&gt;'s)</b> <b>OK</b>	The Test command returns the possible active NAM's values.

The following table shows the +SNAM parameters.

**Table 3-144: +SNAM Parameters**

<Parameter>	Description
<b>&lt;active nam&gt;</b>	1 First active NAM 2 Second active NAM

**Notes:**

- The number of the maximum allowed NAM profiles is currently 2.
- To choose the maximum allowed NAM profile, bits '6' and '7' of option byte '3' must be configured as follows:
  1. If bit 6 = 0 and bit 7=0 then a single NAM profile is allowed.
  2. If bit 6 = 1 and bit 7=0 then two NAM profiles are allowed.

## PRL Commands

The Preferred Roaming List (PRL) is a database residing in a wireless (primarily CDMA) device, such as a cellphone, that contains information used during the system selection and acquisition process. In the case of RUIM-based CDMA devices, the PRL resides on the RUIM. The PRL indicates which bands, sub bands and service provider identifiers will be scanned and in what priority order. Without a PRL, the device may not be able to roam, i.e. obtain service outside of the home area. There may be cases where missing or corrupt PRL's can lead to a customer not having service at all.

On many networks, regularly updating the PRL is advised if the subscriber uses the device outside the home area frequently, particularly if they do so in multiple different areas. This allows the phone to choose the best roaming carriers, particularly "roaming partners" with whom the home carrier has a cost-saving roaming agreement, rather than using non-affiliated carriers. PRL files can also be used to identify home networks along with roaming partners, thus making the PRL an actual list that determines the total coverage of the subscriber, both home and roaming coverage.

The PRL is built by an operator and is normally not accessible to the user. Many operators provide the ability for the user to download the latest PRL to their device by dialing the Over-the-air (OTA) feature code \*228.

### PRL Structure

The PRL consists of two tables (along with some header and overhead information) (see [Figure 3-8](#)):

**Acquisition Table** - An indexed list of frequencies on which the device may search for particular systems. The idea behind the acquisition table is to optimize the acquisition time by identifying only the frequencies that should be searched, rather than searching the entire frequency spectrum. The information contained in each acquisition table entry includes an index, the network type, and associated channel blocks.

**System Table** - A prioritized list of systems that the device is permitted to access (Preferred Systems) and those that it is explicitly forbidden to access (Negative Systems). Note that it is also possible to indicate forbidden systems using a separate SID/NID Lockout List in the handset; however, this is not a recommended approach as it creates control over system selection outside of the PRL.

Each system table entry belongs to a geographic area known as a GEO. These GEOs are listed in priority order. Each IS-95/1xRTT system is identified by either SID/NID or, in the case of enhanced PRL, SID/NID or MCC/MNC. To support 1xEV-DO systems, the PRL must be IS-683-C or later. Each 1xEV-DO system is identified by a Subnet ID. For hybrid mode operation (i.e. IS-95/1xRTT and 1xEV-DO), association tags are used link an IS-95/1xRTT system with one or more 1xEV-DO systems. Hybrid systems always attempt to select an IS-95/1xRTT system first, then use the association tag to attempt to select an associated 1xEV-DO system.

Each entry also provides an acquisition table index where the frequencies associated with that system are identified and a roaming indicator that dictates what type of indication should be displayed to the user when they are receiving service from that system.

List ID	00702	PR List Size (bytes / bits)	3021 / 24168	SSPR Download & PRL format	0
Preferred Only	FALSE	Number of Acquisition Records	13	Number of Common Subnet Records	0
Default Roaming Indication	0x00 On	Number of System Records	700		
Multiple PRL...	PRL Number 1	PR List CRC	54519		

Acquisition Table		
Type	Data	
0 Cellular CDMA (Custom Channels)	384	
1 PCS Channels	325,850,750,925	
2 Cellular CDMA (Custom Channels)	283	
3 Cellular CDMA (Standard Channels)	System B	Primary CDMA
4 Cellular CDMA (Standard Channels)	System A	Primary CDMA
5 Cellular Analog	System B	
6 Cellular Analog	System A	
7 PCS Blocks	A	
8 PCS Blocks	B	
9 PCS Blocks	C	
10 PCS Blocks	D	
11 PCS Blocks	E	
12 PCS Blocks	F	
*		

System Table												
	SID	NID	Negative/ Preferred System	Geographical Region Indicator	Priority	Acquisition Record	Roaming Indication	Association Inc	Association Tag	PN Association	Data Association	Sys Record Type
0	1267	65535	Preferred	New (0)	Same (0)	0	0x01 Off					
1	1267	65535	Preferred	Same (1)	Same (0)	1	0x01 Off					
2	2129	65535	Preferred	Same (1)	Same (0)	1	0x01 Off					
3	1367	65535	Preferred	Same (1)	Same (0)	2	0x01 Off					
4	1369	65535	Preferred	Same (1)	More (1)	2	0x01 Off					
5	26	65535	Preferred	Same (1)	Same (0)	3	0x02 Flashing					
6	316	65535	Preferred	Same (1)	Same (0)	3	0x02 Flashing					
7	330	65535	Preferred	Same (1)	Same (0)	3	0x02 Flashing					
8	1548	65535	Preferred	Same (1)	Same (0)	3	0x02 Flashing					
9	528	65535	Preferred	Same (1)	Same (0)	3	0x02 Flashing					
10	3066	65535	Preferred	Same (1)	More (1)	3	0x02 Flashing					
11	1372	65535	Preferred	Same (1)	More (1)	3	0x02 Flashing					
12	1370	65535	Preferred	Same (1)	Same (0)	5	0x01 Off					
13	1367	65535	Preferred	Same (1)	Same (0)	6	0x01 Off					
14	1369	65535	Preferred	Same (1)	More (1)	6	0x01 Off					
15	26	65535	Negative	Same (1)	Omitted	11	0x00 On					
16	26	65535	Negative	Same (1)	Omitted	10	0x00 On					
17	330	65535	Negative	Same (1)	Omitted	10	0x00 On					

Figure 3-8: PRL structure taken from MOTOROLA PST

## PRL Modes of Operation

The PRL may operate in one of two modes, dictated by a Preferred Only indicator:

**Restrictive Mode (a.k.a. Closed PRL, Preferred Only Mode)** - The device will only acquire systems identified as preferred in the PRL system table. While this mode of operation gives operators the most control over the system selection process, it requires that PRLs be kept up-to-date to ensure that newly added roaming partners can be selected. Note that even if a PRL is restrictive according to the preferred only indicator, the use of wildcard SID/NID or MCC/MNC values as preferred systems would essentially make the PRL permissive because wild cards match any system that is located.

**Permissive Mode (a.k.a. Open PRL, Not Preferred Mode)** - The device will attempt to acquire preferred systems; however, if no preferred systems can be located, the device may select systems that are not listed in the PRL system table. It still will not select negative systems; but, if no preferred systems can be found and an unknown system is available, it will select the unknown

system. While this mode of operation is easier to maintain because new partners can be chosen even if they are not explicitly listed in the PRL, it carries with it the danger of allowing the mobile device to become camped onto a system that will not provide it with service.

### +CPRL1, Set/Get PRL Header

This command set/get the PRL header parameters.

**Notes:**

- When changing list id (first parameter) the PRL tables reset to default.
- C24 will perform power cycle after set command executed in order to make changes active.
- SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CPRL1=<list id>,<preferred only>,<default roam ind>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The set commands set the header parameters of the PRL When changing the list id (first parameter), the PRL tables reset to their default values.
<b>Read</b>	AT+CPRL1?	+CPRL1: <list id>,<preferred only>,<default roam ind>,<current num>,<buffer size>,<number of Acquisition row>,<number of system row> <b>OK</b>	The Read command returns the current values of PRL1 parameters.
<b>Test</b>	AT+CPRL1=?	+CPRL1: (list of supported <list id>'s), (list of supported <preferred only>'s), (list of supported <default roam ind>'s) <b>OK</b>	The Test command returns the possible values of changeable parameters in PRL1 command.

**Note:** The default PRL data is 1 row for each one of the tables:

**Acquisition default row:** type - 1 (Cellular Analog), data - 0 (System A).

**System default row:** SID - 0, NID - 65535, Preferred/Negative - 1 (Preferred), GEO region - 0 (New), Priority - 0 (Same), Acq. Index - 0, Roaming Indicator - 0 (On).



The following table shows the +CPRL1 parameters.

**Table 3-145: +CPRL1 Parameters**

<Parameter>	Description	Remarks
<list id>	The PRL version.	
<preferred only>	If TRUE then limit the registration on system that is preferred in PRL system table.	
<default roam ind>	The indicator used when we registered on default system 0 On 1 Off 2 Flashing 3 Out of Neighborhood 4 Out of Building 5 Preferred System 6 Available System 7 Alliance Partner 8 Premium Partner 9 Full Service 10 Partial Service 11 Banner On 12 Banner Off 255 Programmable Reserved	
<current num>	The current NAM (need to be set by the user with AT+SNAM).	Read only. Set by +SNAM.
<buffer size>	Currently used PRL buffers (in bytes).	Read only.
<number of Acquisition row>	Currently set acquisition rows in acquisition table.	Read only.
<number of system row>	Currently set system rows in system table.	Read only.



## +CPRL2, Managing PRL Acquisition Table

This command enables the user to control the PRL acquisition table, as follows:

- Returns the number of the current rows in the table.
- Returns specific row parameters.
- Updates a specific row in the table or adds a specific row to the table.

### Notes:

- This command changes the amount of parameters depending on the acquisition row type (3rd parameter).
- C24 will perform power cycle after set command executed in order to make changes active.
- SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<p>+CPRL2=&lt;operation&gt;,&lt;Row index&gt;</p> <p>Or</p> <p>+CPRL2=&lt;operation&gt;,&lt;Row index + 1&gt;,&lt;Acq.Type&gt;,&lt;data&gt;[,&lt;data&gt;[...]]</p>	<p><u>In case operation = 0:</u> +CPRL2: &lt;Row index&gt;,&lt;Acq.type&gt;,&lt;data&gt;[,&lt;data&gt;[...]] OK</p> <p><u>In case operation = 1:</u> OK</p> <p>Or: +CME ERROR: &lt;err&gt;</p>	<p>The set commands manage the PRL acquisition table.</p> <p><u>In case operation = 0:</u></p> <ul style="list-style-type: none"> <li>• Acquisition table is being read.</li> <li>• It returns the parameters of the row of the given row index.</li> <li>• When acquisition type is 2,3,5 or 6, then there can be more than one data fields, although the data fields are occupied within parentheses.</li> </ul> <p><u>In case operation = 1:</u></p> <ul style="list-style-type: none"> <li>• Acquisition tables is updated.</li> <li>• If row index equals to &lt;numbers of current Acq. Row&gt;, then a new row is inserted.</li> </ul>
<b>Read</b>	AT+CPRL2?	+CPRL2: <number of current Acq. Row> OK	The Read command returns the current number of rows in the acquisition table.
<b>Test</b>	AT+CPRL2=?	+CPRL2: (list of supported <operation>'s), (list of supported <Row index>'s), (list of supported <acq. Type>'s) , (list of supported <data>'s) OK	The Test command returns the possible values parameters in the set command.

The following table shows the +CPRL2 parameters.

**Table 3-146: +CPRL2 Parameters**

<Parameter>	Description	Remarks
<operation>	0 - Read data 1- Write data	
<number of current Acq. Row>	The number of the actual rows in acquisition table.	The same as <number of Acquisition row> parameter given from AT+CPRL1.
<Row index>	The index of the row.	Starts from 0.

**Table 3-146: +CPRL2 Parameters (Cont.)**

<Parameter>	Description	Remarks																										
<Aqc. Type>	The type of acquisition (the channel group) 1 - Cellular Analog 2 - Cellular CDMA (Standard Channels) 3 - Cellular CDMA (Custom Channels) 4 - Cellular CDMA Preferred 5 - PCS Blocks 6 - PCS channels	Group 1-4: are 800Mhr group channels. Group 5-6: are the 1900Mhr group channel  Group 1,4: have 1 data field. Group 2: has 2 data fields. Group 5: has up to 6 data fields. Group 3,6: have up to 10 data fields.																										
<data>	<table><tr><th>Type</th><th colspan="2">Data</th></tr><tr><td>0(Reserved)</td><td colspan="2">N/A.</td></tr><tr><td>1(Cellular Analog)</td><td colspan="2">0 (System A) or 1 (System B) or  3 (System A or B)</td></tr><tr><td rowspan="2">2 Cellular CDMA (Standard Channels)</td><td>Data1</td><td>Data2</td></tr><tr><td>0 (System A) or 1 (System B) or  3 (System A or B)</td><td>1 (Primary CDMA) or 2 (Secondary CDMA) or 3 (Primary or Secondary).</td></tr><tr><td>3(Cellular CDMA (Custom Channels))</td><td colspan="2">SystemA: 1-311, 689-694, 1013-1023. System B: 356-644, 739-777.</td></tr><tr><td>4(Cellular CDMA Preferred)</td><td colspan="2">0 (System A) or 1 (System B) or 3 (System A or B)</td></tr><tr><td>5(PCS Blocks).</td><td colspan="2">0 (block A) 1 (block B) 2 (block C) 3 (block D) 4 (block E) 5 (block F) or instead: 7 (block W) as wildcard.</td></tr><tr><td>6(PCS Channels)</td><td colspan="2">25 - 1175</td></tr></table>		Type	Data		0(Reserved)	N/A.		1(Cellular Analog)	0 (System A) or 1 (System B) or  3 (System A or B)		2 Cellular CDMA (Standard Channels)	Data1	Data2	0 (System A) or 1 (System B) or  3 (System A or B)	1 (Primary CDMA) or 2 (Secondary CDMA) or 3 (Primary or Secondary).	3(Cellular CDMA (Custom Channels))	SystemA: 1-311, 689-694, 1013-1023. System B: 356-644, 739-777.		4(Cellular CDMA Preferred)	0 (System A) or 1 (System B) or 3 (System A or B)		5(PCS Blocks).	0 (block A) 1 (block B) 2 (block C) 3 (block D) 4 (block E) 5 (block F) or instead: 7 (block W) as wildcard.		6(PCS Channels)	25 - 1175	
Type	Data																											
0(Reserved)	N/A.																											
1(Cellular Analog)	0 (System A) or 1 (System B) or  3 (System A or B)																											
2 Cellular CDMA (Standard Channels)	Data1	Data2																										
	0 (System A) or 1 (System B) or  3 (System A or B)	1 (Primary CDMA) or 2 (Secondary CDMA) or 3 (Primary or Secondary).																										
3(Cellular CDMA (Custom Channels))	SystemA: 1-311, 689-694, 1013-1023. System B: 356-644, 739-777.																											
4(Cellular CDMA Preferred)	0 (System A) or 1 (System B) or 3 (System A or B)																											
5(PCS Blocks).	0 (block A) 1 (block B) 2 (block C) 3 (block D) 4 (block E) 5 (block F) or instead: 7 (block W) as wildcard.																											
6(PCS Channels)	25 - 1175																											

## +CPRL3, Managing PRL Acquisition Table

This command enables the user to control the PRL System table, as follows:

- Returns the number of the current rows in the table.
- Returns specific row parameters.
- Updates a specific row in the table or adds a specific row to the table.

### Notes:

- C24 will perform power cycle after set command executed in order to make changes active.
- SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<p>+CPRL3=&lt;operation&gt;,&lt;Row index&gt;</p> <p>Or</p> <p>+CPRL3=&lt;operation&gt;,&lt;Row index + 1&gt;,&lt;sid&gt;,&lt;nid&gt;,&lt;preferred/negative&gt;,&lt;Geo. Region&gt;,&lt;priority&gt;,&lt;Acq. Index&gt;,&lt;roam ind.&gt;</p>	<p><b><u>In case operation = 0:</u></b></p> <p>+CPRL3: &lt;Row index&gt;,&lt;sid&gt;,&lt;nid&gt;,&lt;preferred/negative&gt;,&lt;Geo. Region&gt;,&lt;priority&gt;,&lt;Acq. Index&gt;,&lt;roam ind.&gt;</p> <p>OK</p> <p><b><u>In case operation = 1:</u></b></p> <p>OK</p> <p>Or</p> <p>+CME ERROR: &lt;err&gt;</p>	<p>The set commands manage the PRL system table.</p> <p><b><u>In case operation = 0:</u></b></p> <ul style="list-style-type: none"> <li>• It returns the parameters of the row of the given row index.</li> <li>• Always returns all eight parameters.</li> <li>• If row is negative, the last &lt;priority&gt; and &lt;roam ind&gt; parameters shall be ignored.</li> </ul> <p><b><u>In case operation = 1:</u></b></p> <ul style="list-style-type: none"> <li>• If a row index equals to &lt;numbers of current vs. Row&gt;, then a new row is inserted. The first row is always set to &lt;Geo. Region&gt;= 0.</li> <li>• If a row is changed from preferred to negative, the &lt;priority&gt; and &lt;roam ind&gt; are ignored.</li> <li>• If a row is changed from negative to preferred, then you must enter valid values for the fields &lt;priority&gt; and &lt;roam ind&gt;.</li> <li>• If row is negative: &lt;priority&gt; and &lt;roam ind&gt; cannot be changed.</li> </ul>

Command Type	Syntax	Response/Action	Remarks
<b>Read</b>	AT+CPRL3?	+CPRL3: <number of current Sys. Row> OK	The Read command returns the number of rows in the system table.
<b>Test</b>	AT+CPRL3=?	+CPRL3: (list of supported <operation>'s), (list of supported <Row index>'s), (list of supported <sid>'s) , (list of supported <nid>'s),(list of supported <preferred/negative>'s), (list of supported <Geo. Region>'s),(list of supported <Acq. Index>'s), , (list of supported <roam ind>'s) OK	The Test command returns the possible values parameters in the set command.

The following table shows the +CPRL3 parameters.

**Table 3-147: +CPRL3 Parameters**

<Parameter>	Description	Remarks
<operation>	0 - Read data 1- Write data	
<number of current Sys. Row>	The number of the actual row in system table.	The same as the 7th parameter given from AT+CPRL1?.
<Row ind>	The index of the row.	Starts from 0.
<sid>	System ID 0-32767	
<nid>	Network ID 0-65535	65535 - is a Wildcard means registering on every founded NID. 0 -
<preferred/negative>	Choose if the system row is Preferred or Negative. 1 - Preferred 0 - Negative	Preferred - this is a valid row to be checked while seeking the PRL after system to register on. Negative - this row will be ignored during the seeking for a system.
<Geo. Region>	Geographical region: 0 - new 1 - same	The first row in system table always has the value 0.

**Table 3-147: +CPRL3 Parameters (Cont.)**

<Parameter>	Description	Remarks
<priority>	The priority of the system against other system rows in the same area. 0 - Same 1 - More	This field is actual only if the row is not Negative.
<Acq. Index>	Acquisition table row index.	Must have a valid row index in the acquisition table.
<roam ind.>	The Roaming Indicator to be used when the registration is made on this system row. (SID,NID and channel) 0 On 1 Off 2 Flashing 3 Out of Neighborhood 4 Out of Building 5 Preferred System 6 Available System 7 Alliance Partner 8 Premium Partner 9 Full Service 10 Partial Service 11 Banner On 12 Banner Off 255 Programmable Reserve	This field is actual only if the row is not Negative.

## +CPRL4, Upload Entire PRL File

This command enables the user to upload an entire PRL binary file as a whole through AT commands.

- Note:**
- C24 will perform power cycle after upload finished in order to make changes active and load in the new PRL file.
  - SPC must be unlocked in order to activate the command, if SPC is locked +CME Error returns to TE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CPRL4=<nam_index>,<length><CR><data>	+CPRL4: <status> OK Or: +CME ERROR: <err>	
<b>Read</b>	AT+CPRL4?	+CPRL4: <nam_index> OK	The Read command returns the number NAM selected.
<b>Test</b>	AT+CPRL4=?	+CPRL4: (list of supported <nam_index>'s) OK	The Test command returns the possible values.

The following table shows the +CPRL4 parameters.

**Table 3-148: +CPRL4 Parameters**

<Parameter>	Description	Remarks
<nam_index>	1 - NAM1 2 - NAM2	
<data>	PRL data 00...FF	
<status>	0 - PRL stored successfully. 1 - Memory size error.	

## PRI Commands

### +MPRISUM, Read PRI Checksum

This command return the PRI checksum.

Command Type	Syntax	Response/Action
Read	AT+MPRISUM?	+MPRISUM: <checksum> <b>OK</b> or: +CME ERROR: <err>

The following table shows the +MPRISUM parameters.

**Table 3-149: +MPRISUM Parameters**

<Parameter>	Description
<checksum>	Checksum of Program Release Instructions.

## Error Handling Commands

### +CMEE, Report Mobile Equipment Error

The Set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the C24. When enabled, C24-related errors cause a +CME ERROR: <err> final result code instead of the regular ERROR final result code. Usually, ERROR is returned when the error is related to syntax, invalid parameters or terminal functionality.

For all Accessory AT commands besides SMS commands, the +CMEE set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the C24. When enabled, C24 related errors cause a +CME ERROR: <err> final result code instead of the regular ERROR result code.

For all SMS AT commands that are derived from GSM 07.05, the +CMEE Set command disables or enables the use of result code +CMS ERROR: <err> as an indication of an error relating to the functionality of the C24. When enabled, C24-related errors cause a +CMS ERROR: <err> final result code instead of the regular ERROR final result.



Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CMEE=[<n>]	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command enables or disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the C24.
<b>Read</b>	AT+CMEE?	<b>+CMEE: &lt;n&gt;</b> <b>OK</b>	The Read command returns the current setting format of the result code.
<b>Test</b>	AT+CMEE=?	<b>+CMEE: (list of supported &lt;n&gt;s)</b> <b>OK</b>	The Test command returns values supported by the terminal as a compound value.

The following table shows the +CMEE parameters.

**Table 3-150: +CMEE Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	0     Disable the +CME ERROR: <err> result code and use ERROR. 1     Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use numeric <err> values. 2     Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use verbose <err> values. The default value is 0.

**Table 3-151: +CME Errors**

<err>		
Numeric	Verbos	Comment
0	"phone failure"	
3	"operation not allowed"	Operation in Command not allowed.
4	"operation not supported"	When feature is not supported.
10	"R-UIM not inserted"	
11	"R-UIM PIN required"	
12	"R-UIM PUK required"	
13	"R-UIM failure"	
14	"R-UIM busy"	
15	"R-UIM wrong"	

**Table 3-151: +CME Errors (Cont.)**

<err>		
Numeric	Verbos	Comment
16	"incorrect password"	Wrong password inserted.
18	"R-UIM PUK2 required"	
20	"memory full"	e.g. PB memory is full.
21	"invalid index"	Trying to access a non existing index.
22	"not found"	
23	"memory failure"	Writing to memory failed of any cause.
24	"text string too long"	Whenever a text input length is bigger than the max allowed.
25	"invalid characters in text string"	Incorrect text in text parameter.
26	"dial string too long"	Related with all dial commands.
27	"invalid characters in dial string"	Related with all dial commands.
30	"no network service"	Related with all commands.
32	"network not allowed - emergency calls only"	Related with all dial commands.
33	"command aborted"	User aborted (usually with ESC) after execution of command when command is not fully executed.
34	"numeric parameter instead of text parameter"	Parameter entered incorrectly, without (" ").
35	"text parameter instead of numeric parameter"	Parameter entered incorrectly, without (" ").
36	"numeric parameter out of bounds"	Entered parameter is out of bounds.
37	"text string too short"	Whenever a text input length is smaller than the Min allowed.
100	"unknown"	AT command not found in AT list.
149	"PPP authentication failure"	
256	"too many active calls"	Trying to make a call while 3 way call is active.
257	"call rejected"	Call rejected by network.
259	"unknown calling error"	
260	"no phone num recognized"	Related with D> command, when dialing from PB by "alpha".
264	"unlock code required"	Phone is locked.
265	"network busy"	Network related error.
281	"Invalid message body length"	TCP/IP related.
282	"inactive socket"	TCP/IP related.

**Table 3-151: +CME Errors (Cont.)**

<err>		
Numeric	Verbos	Comment
283	"socket already open"	TCP/IP related.
284	"ODM session is active"	TCP/IP related.
285	"FTP session is inactive"	
286	"UNLOCK CODE required"	When C24 is locked.
287	"SPC required"	When SPC is locked.
288	"Excess SPC failures"	After 15 retries of unlock the SPC.
500	"error in charging process"	
501	"No battery detection"	
502	"Command line too long"	
503	"Command parameters number large than 13"	
504	"Commands number out of bounds in command line"	
505	"IP address error"	
506	"incorrect A key"	

**Table 3-152: +CMS Errors**

<err>		
Numeric	Verbos	Comment
21	"Short message transfer rejected"	
159	"Unspecified TP-DCS error"	Discrepancy between Character set (Language) and DCS.
198	"TP-VPF not supported"	Discrepancy between type of validity period and validity period (+CSMP).
199	"TP-VP not supported"	Discrepancy between type of validity period and validity period (+CSMP).
208	"R-UIR SMS storage full"	
211	"Memory Capacity Exceeded"	
302	"operation not allowed"	Operation in or with Command not allowed regarding SMS feature.
303	"operation not supported"	When feature is not supported regarding SMS feature.
304	"invalid PDU mode parameter"	Trying to write PDU SMS when format is set to text.

**Table 3-152: +CMS Errors (Cont.)**

<err>		
Numeric	Verbos	Comment
305	"invalid text mode parameter"	Trying to write text SMS when format is set to PDU.
320	"memory failure"	SMS memory not ready.
321	"invalid memory index"	SMS index don't exist.
322	"memory full"	SMS storage is full.
340	"no +CNMA acknowledgement expected"	+CNMA is executed but no acknowledgment is expected.
513	"invalid destination address"	SMS related.
514	"invalid message body length"	SMS related.
515	"phone is not in service"	SMS related.
516	"invalid preferred memory storage"	SMS related.
517	"user terminated"	SMS related.

**Example**

```

AT+CMEE=0           //+CME ERROR is not used
OK
AT+VTD
ERROR
AT+CMEE=1           //Use numeric <err>
OK
AT+VTD
+CME ERROR: 1
AT+CMEE=2           //Use verbose <err>
OK
AT+VTD
+CME ERROR: operation not supported

```

**+CEER, Extended Error Report**

This execution command returns an extended error report containing one or more lines of information text <report>, determined by the manufacturer, providing reasons for the following errors:

- Failure in the last unsuccessful call setup (originating or answering) or the in-call modification.
- Last call release.

Typically, the text consists of a single line containing the reason for the error according to information given by CDMA network, in textual format.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CEER=[<n>]	OK
<b>Execute</b>	AT+CEER	+CEER: <report> OK
<b>Read</b>	AT+CEER?	+CEER: <n> OK
<b>Test</b>	AT+CEER=?	+CEER: (List of supported <n>s) OK

The following table shows the +CEER parameters.

**Table 3-153: +CEER Parameters**

<Parameter>	Description
<n>	1 Returns numeric response. 2 Returns verbose response. The default value is 2.
<report>	<ul style="list-style-type: none"> <li>Value of report should be given according to CDMA network error events.</li> <li>The total number of characters and line terminators (up to 2041) in the information text.</li> <li>The text must not contain the sequence 0&lt;CR&gt; or OK&lt;CR&gt;.</li> </ul> <p>Numeric format followed by verbose format:</p> <ul style="list-style-type: none"> <li>0 CEER No information available</li> <li>1 CEER Phone is offline</li> <li>21 CEER Phone is CDMA locked until power cycle</li> <li>22 CEER Phone has no service</li> <li>23 CEER Call has ended abnormally</li> <li>24 CEER Received intercept from BS</li> <li>25 CEER Received reorder from BS</li> <li>26 CEER Received release from BS - no reason given</li> <li>27 CEER Received release from BS - SO reject</li> <li>28 CEER Received incoming call from BS</li> <li>29 CEER Received alert stop from BS</li> <li>30 CEER Client ended the call</li> <li>31 CEER Received end activation</li> <li>32 CEER MC aborts the origination/conversation</li> <li>33 CEER Max access probes transmitted</li> <li>34 CEER Persistence test failure</li> <li>35 CEER RUIM is not present</li> <li>36 CEER Access attempt already in progress</li> <li>37 CEER Access failure</li> <li>38 CEER Received retry order</li> <li>39 CEER Concurrent service is not supported by base station</li> <li>40 CEER No response received from base station</li> <li>41 CEER Call rejected by the base station</li> <li>42 CEER Concurrent services requested were not compatible</li> <li>43 CEER Access is blocked by base station</li> <li>44 CEER Corresponds to CM_CALL_ORIG_ERR_ALREADY_IN_TC</li> <li>45 CEER Call is ended due to Emergency call is flashed over this call</li> <li>46 CEER CM is ending a GPS call in favor of a user call</li> <li>47 CEER CM is ending a SMS call in favor of a user call</li> <li>48 CEER CM is ending a DATA call in favor of an emergency call</li> <li>49 CEER Call rejected because of redirection or handoff</li> <li>50 CEER Access is blocked by base station for all mobiles</li> <li>51 CEER OTASP SPC Error</li> </ul>

### Example

```

AT+CEER
+CEER: "CEER_No_information_available"
OK
AT+CEER?

```

```
+CEER:2
OK
AT+CEER=?
+CEER: (1-2)
OK
```

### +MSPC, SPC Unsolicited Error Report

This insolated message displays an error report in case the network set incorrect password for more times than permitted.

Command Type	Syntax	Response/Action	Remarks
Unsolicited Report	+MSPC: "Excess SPC failures"	OK	

### Re-Flash mode

#### +MREFLASH, Enter to Re-Flash Mode

While running the application mode in command or pseudo command, C24 will be able to receive AT+MREFLASH command and as a result it will enter the Re-flash mode.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MREFLASH	OK or: +CME ERROR: <err>	Error code: 0, "phone failure"

## Mobile IP Configuration

### \$QCMIPNAI, Set NAI for Active Profile

This command sets the NAI for the currently active profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPNAI =<nai>,<val>	OK  or:  +CME ERROR: <err>
Read	AT\$QCMIPNAI?	+QCMIPNAI: <nai>,<val> OK
Test	AT\$QCMIPNAI=?	+QCMIPNAI: <List of supported val>

The following table shows the AT\$QCMIPNAI parameters.

**Table 3-154: \$QCMIPNAI Parameters**

<Parameter>	Description
<nai>	Network access identifier string.
<val>	0 - do not commit to NV 1 - commit to NV



- Note:**
- Double quotes are only required if the string contains a comma.
  - If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

### \$QCMIPPHA, Set Primary HA IP Address

This command sets the primary HA IP for the currently active profile.

Command Type	Syntax	Response/Action
<b>Set</b>	AT\$QCMIPPHA =<ip>,<val>	OK  or:  +CME ERROR: <err>
<b>Read</b>	AT\$QCMIPPHA?	+QCMIPPHA: <ip>,<val> OK
<b>Test</b>	AT\$QCMIPPHA =?	+QCMIPPHA: <List of supported ip>,<List of supported val> OK

The following table shows the AT\$QCMIPPHA parameters.

**Table 3-155: \$QCMIPPHA Parameters**

<Parameter>	Description
<ip>	(0-255),(0-255),(0-255),(0-255).
<val>	0 - do not commit to NV 1 - commit to NV

- Note:** If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

## \$QCMIPSHA, Set Secondary HA IP Address

This command sets the secondary HA IP for the currently active profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPSHA =<ip>,<val>	OK  or:  +CME ERROR: <err>
Read	AT\$QCMIPSHA?	+QCMIPSHA: <ip>,<val> OK
Test	AT\$ QCMIPSHA=?	+QCMIPSHA: <List of supported ip>,<List of supported val> OK

The following table shows the AT\$QCMIPSHA parameters.

**Table 3-156: \$QCMIPSHA Parameters**

<Parameter>	Description
<ip>	(0-255),(0-255),(0-255),(0-255).
<val>	0 - do not commit to NV 1 - commit to NV

**Note:** If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

## \$QCMIPHA, Set HA IP Address

This command sets the HA IP for the currently active profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPHA =<ip>,<val>	OK  or:  +CME ERROR: <err>

Command Type	Syntax	Response/Action
Read	AT\$QCMIPHA?	+QCMIPHA: <ip>,<val> OK
Test	AT\$QCMIPHA =?	+QCMIPHA: <List of supported ip>,<List of supported val> OK

The following table shows the AT\$QCMIPHA parameters.

**Table 3-157: \$QCMIPHA Parameters**

<Parameter>	Description
<ip>	(0-255),(0-255),(0-255),(0-255).
<val>	0 - do not commit to NV 1 - commit to NV

**Note:** If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

### \$QCMIPMHSS, Set MN-HA Shared Secrets

This command sets the MN-HA shared secret for the currently active profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPMHSS =<string>,<val>	OK  or:  +CME ERROR: <err>
Read	AT\$QCMIPMHSS?	\$QCMIPMHSS: <string>,<val>  OK  OR  \$QCMIPMHSS: Unset  OK
Test	AT\$QCMIPMHSS=?	\$QCMIPMHSS: <List of supported val> OK

The following table shows the AT\$QCMIPMHSS parameters.

**Table 3-158: \$QCMIPMHSS Parameters**

<Parameter>	Description
<string>	Shared secret string.
<val>	0 - do not commit to NV 1 - commit to NV

- Note:**
- Double quotes are only required if the string contains a comma.
  - If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

## **\$QCMIPMASS, Set MN-AAA Shared Secrets**

This command sets the MN-AAA shared secret for the currently active profile.

Command Type	Syntax	Response/Action
<b>Set</b>	AT\$QCMIPMASS =<string>,<val>	OK  or:  +CME ERROR: <err>
<b>Read</b>	AT\$QCMIPMASS?	+QCMIPMASS: <string>,<val> OK
<b>Test</b>	AT\$QCMIPMASS=?	+QCMIPMASS: <List of supported val> OK

The following table shows the AT\$QCMIPMASS parameters.

**Table 3-159: \$QCMIPMASS Parameters**

<Parameter>	Description
<string>	Shared secret string.
<val>	0 - do not commit to NV 1 - commit to NV

- Note:**
- Double quotes are only required if the string contains a comma.
  - If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

### \$QCMIPMHSPi, Set MN-HA SPI Secrets

This command sets the MN-HA SPIs for the currently active profile.

Command Type	Syntax	Response/Action
<b>Set</b>	AT\$QCMIPMHSPi =<spi>,<val>	OK  or:  +CME ERROR: <err>
<b>Read</b>	AT\$QCMIPMHSPi?	+QCMIPMHSPi: <spi>,<val> OK
<b>Test</b>	AT\$QCMIPMHSPi =?	+QCMIPMHSPi: <List of supported spi>,<List of supported val>

The following table shows the AT\$QCMIPMHSPi parameters.

**Table 3-160: \$QCMIPMHSPi Parameters**

<Parameter>	Description
<spi>	SPI value.
<val>	0 - do not commit to NV 1 - commit to NV

- Note:** If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

## \$QCMIPMASPI, Set MN-AAA SPI Secrets

This command sets the MN-AAA SPIs for the currently active profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPMASPI =<spi>,<val>	OK  or:  +CME ERROR: <err>
Read	AT\$QCMIPMASPI?	+QCMIPMASPI: <spi>,<val> OK
Test	AT\$QCMIPMASPI =?	+QCMIPMASPI: <List of supported spi>,<List of supported val>  OK

The following table shows the AT\$QCMIPMASPI parameters.

**Table 3-161: \$QCMIPMASPI Parameters**

<Parameter>	Description
<spi>	SPI value.
<val>	0 - do not commit to NV 1 - commit to NV

**Note:** If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

## \$QCMIPRT, Set Reverse Tunneling Preference

This command sets the reverse tunneling preference for the currently active profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPRT =<reverse tunneling>,<val>	OK  or:  +CME ERROR: <err>

Command Type	Syntax	Response/Action
Read	AT\$QCMIPRT?	+QCMIPRT: <reverse tunneling>,<val> OK
Test	AT\$QCMIPRT =?	+QCMIPRT: <List of supported reverse tunneling>,<List of supported val> OK

The following table shows the AT\$QCMIPRT parameters.

**Table 3-162: \$QCMIPRT Parameters**

<Parameter>	Description
<reverse tunneling>	0 - do not request reverse tunneling. 1 - request reverse tunneling.
<val>	0 - do not commit to NV 1 - commit to NV

**Note:** If the value provisioned is not committed to NV, the temporary values will be deleted at the end of the following call or if \$QCMIPP is called.

### \$QCMIPPEP, Enable/disable Active Profile

This command enables/disables the currently active profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPPEP =<mode>	OK  or: +CME ERROR: <err>
Read	AT\$QCMIPPEP?	+QCMIPPEP: <mode> OK
Test	AT\$QCMIPPEP =?	+QCMIPPEP: <List of supported modes> OK

The following table shows the AT\$QCMIPPEP parameters.

**Table 3-163: \$QCMIPPEP Parameters**

<Parameter>	Description
<mode>	0 - Disable the currently active profile (profile is unavailable until it is re-enabled). 1 - Enable the currently active profile.

## \$QCMIPGETP, Display Information to Specific Profile

This command returns the information to a specific profile.

Command Type	Syntax	Response/Action
Set	AT\$QCMIPGETP =<index>	\$QCMIPGETP: <information> OK  or:  +CME ERROR: <err>
Test	AT\$QCMIPGETP =?	+QCMIPGETP: <List of supported indexes>  OK

The following table shows the AT\$QCMIPGETP parameters.

**Table 3-164: \$QCMIPGETP Parameters**

<Parameter>	Description
<index>	0-5

**Notes:**

- If no profile number is entered, all information corresponding to the currently active profile is returned.
- If there is no profile associated with the specified number, as error is returned.



## Data Capabilities

### \$QCQNC, Enable Disable Quick Net Connect (QNC)

This command enables/disables Quick Net Connect (QNC).

Command Type	Syntax	Response/Action
Set	\$QCQNC=<n>	OK  or:  ERROR: <error_code>
Read	\$QCQNC?	\$QCQNC: <n> or +CME ERROR <err>
Test	\$QCQNC=?	\$QCQNC: (List of supported <n>s)

The following table shows the QCQNC parameters.

**Table 3-165: \$QCQNC Parameters**

<Parameter>	Description
<n>	0 - disables QNC capability; Packet Originations will use the Packet Data Service Option number.  1 - enables QNC capability; Packet Originations will use the Async Data Service Option number.

#### Example

```
AT$QCQNC?
$QCQNC: 1
OK
```

```
AT$QCQNC=0           // Disable QNC capability.
OK
```

## \$QCTRL, R-SCH Throttling Enable/Disable

This command enables/disables IS2000 devices from throttling the R-SCH. The R-SCH is throttled when the assigned R-SCH rate is considered "too high" and could over utilize the CPU.

Command Type	Syntax	Response/Action
Set	\$QCTRL =<n>	OK  or:  ERROR: <error_code>
Read	\$QCTRL?	\$QCTRL: <n> or +CME ERROR <err>
Test	\$QCTRL =?	\$QCTRL: (List of supported <n>s)

The following table shows the QCTRL parameters.

**Table 3-166: \$QCTRL Parameters**

<Parameter>	Description
<n>	0 - mobile never throttles R-SCH.  1 - mobile can throttle R-SCH as needed (default).

- Notes:**
- This command only applies to SO 33 calls.
  - This value is stored in NV.
  - \*For MSM500, MSM5105, and MSM5100 ASICs only.

### Example

```

AT$QCTRL?
$QCTRL: 0
OK
AT$QCTRL=?
$QCTRL: (0-1)
OK
AT$QCTRL=1
OK

```

## \$QCSO, Set Data Service Option

This command sets the Data Service Option number to non-volatile memory.

Command Type	Syntax	Response/Action
<b>Set</b>	<b>\$QCSO=&lt;n&gt;</b>	<b>OK</b>  <b>or:</b>  <b>ERROR: &lt;error_code&gt;</b>
<b>Read</b>	<b>\$QCSO?</b>	<b>\$QCSO: &lt;n&gt;</b>  <b>or</b> <b>+CME ERROR &lt;err&gt;</b>
<b>Test</b>	<b>\$QCSO=?</b>	<b>\$QCSO: (List of supported &lt;n&gt;s)</b>

The following table shows the QCSO parameters.

**Table 3-167: \$QCSO Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	<p>0 - pre-707 SO numbers (RS 1: Async 4, G3 Fax 5, packet 7; RS 2: Async 12, G3 Fax 13, packet 15).</p> <p>1 - proprietary SO numbers (RS 1: Async 4, G3 Fax 5, packet 7; RS 2: Async 0x8021, G3 Fax 0x8022, packet 0x8020).</p> <p>2 - IS-707 SO numbers (RS 1: Async 0x1004, G3 Fax 0x1005, packet 0x1007; RS 2: Async 12, G3 Fax 13, packet 15).</p>

### Example

```

AT$QCSO?
$QCSO: 2
OK
AT$QCSO=?
$QCSO: (0-2)
OK

```

## \$QCMIPT, Enable/Disable RFC2002bis Authentication

This command enables/disables the use of rfc2002bis authentication.

Command Type	Syntax	Response/Action
Set	\$QCMIPT=<n>	OK  or:  ERROR: <error_code>
Read	\$QCMIPT?	\$QCMIPT: <n> or +CME ERROR <err>
Test	\$QCMIPT=?	\$QCMIPT: (List of supported <n>s)

The following table shows the QCMIPT parameters.

**Table 3-168: \$QCMIPT Parameters**

<Parameter>	Description
<n>	0 - Use of RFC 2002bis authentication is disabled. RFC 2002 style authentication is used instead.  1 - Use of RFC 2002bis authentication is enabled.  <b>Note:</b> This AT command is for test purposes only and should not be changed by the user.

### Example

```
AT$QCMIPT?  
$QCMIPT: 0  
OK  
AT$QCMIPT=?  
$QCMIPT: (0-1)  
OK
```

## \$QCMIPP, Select MIP User Profile To Be Active

This command selects MIP user profile to be active.

Command Type	Syntax	Response/Action
<b>Set</b>	<b>\$QCMIPP=&lt;n&gt;</b>	<b>OK</b>  <b>or:</b>  <b>ERROR: &lt;error_code&gt;</b>
<b>Read</b>	<b>\$QCMIPP?</b>	<b>\$QCMIPP: &lt;n&gt;</b> <b>or</b> <b>+CME ERROR &lt;err&gt;</b>
<b>Test</b>	<b>\$QCMIPP=?</b>	<b>\$QCMIPP: (List of supported &lt;n&gt;s)</b>

The following table shows the QCMIPP parameters.

**Table 3-169: \$QCMIPP Parameters**

<Parameter>	Description
<n>	0-5 - Takes a profile number between 0 and 5.  This AT command is expected to be used by users to configure Dial-Up Networking.

### Example

```
AT$QCMIPP?
$QCMIPP: 0
OK
AT$QCMIPP=?
$QCMIPP: (0-5)
OK
```

## \$QCMIP, Enable/Disable Mobile IP

This command enables/disables Mobile IP functionality in the module.

Command Type	Syntax	Response/Action
Set	\$QCMIP=<n>	OK  or:  ERROR: <error_code>
Read	\$QCMIP?	\$QCMIP: <n> or +CME ERROR <err>
Test	\$QCMIP=?	\$QCMIP: (List of supported <n>s)

The following table shows the QCMIP parameters.

**Table 3-170: \$QCMIP Parameters**

<Parameter>	Description
<n>	<p>0 - Mobile IP disabled, Simple IP only (default value).</p> <p>1 - Mobile IP preferred In the initial MIP registration, if the network does not support Mobile IP, the mobile automatically reverts to Simple IP (forces a PPP renegotiation by sending an LCP C-Req).</p> <p>However, if a Mobile IP session is registered, and the mobile enters a network that does not support Mobile IP, it will drop the session and inform the upper layers of the failure (e.g., by dropping DCD to a laptop).</p> <p>2 - Mobile IP only The mobile will make data calls only when Mobile IP is supported in the network. During an MIP session, if the mobile hands off to a network that does not support MIP, the mobile will drop the session and inform the upper layers of the failure (e.g., by dropping DCD to a laptop).</p>

- Notes:**
- When the AT\$QCMIP value is changed to 1 or 2, this modifies the value of AT+CRM to 2. AT+CRM with a value of 2 enables network model operation. Changing the value to 0 will reset the AT+CRM to its original value.
  - This change is not supported by DMSS 5105 Release 1.0 Commercial.
  - When the AT\$QCMIP value is changed to 1 or 2, this modifies the value of AT\$QCMDR to 3. AT\$QCMDR=3 means that the mobile tries Service Option 33 when it is in a cdma2000 network that advertises P\_REV 6 or higher. When

AT\$QCMIP >0 and an attempt is made to set AT\$QCMDR to less than 3, the mobile will return ERROR.

- This AT command is for test purposes only and should not be changed by the mobile phone user.

### Example

```
AT$QCMIP?
$QCMIP: 0
OK
AT$QCMIP=?
$QCMIP: (0-2)
OK
```

## \$QCVAD, Prearrangement Setting

This command responds to a page message that has a voice service option with a page response that has a data service option.

Command Type	Syntax	Response/Action
Set	\$QCVAD=<n>	OK  or:  ERROR: <error_code>
Read	\$QCVAD?	\$QCVAD: <n> or +CME ERROR <err>
Test	\$QCVAD=?	\$QCVAD: (List of supported <n>s)
Execute	\$QCVAD	OK  Set to default (default is 0)

The following table shows the QCVAD parameters.

**Table 3-171: \$QCVAD Parameters**

<Parameter>	Description
<n>	0 - off 1 - fax for next call 2 - fax for all calls 3 - async for next call 4 - async for all calls

**Example**

```

AT$QCVAD?
$QCVAD: 0
OK
AT$QCVAD=?
$QCVAD: (0-4)
OK
AT$QCVAD=1
OK

```

**+CTA, Um Packet Data Inactivity Timer**

This command is used to Set/Read/Test the Um packet data inactivity timer.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CTA=<n>	<b>OK</b>  <b>or:</b>  <b>ERROR: &lt;error_code&gt;</b>
<b>Read</b>	AT+CTA?	<b>+CTA: &lt;n&gt;</b>  <b>or</b> <b>+CME ERROR &lt;err&gt;</b>
<b>Test</b>	AT+CTA=?	<b>+CTA: (List of supported &lt;n&gt;s)</b>
<b>Execute</b>	AT+CTA	<b>OK</b>  <b>Set to default (default is 0)</b>

The following table shows the CTA parameters.

**Table 3-172: +CTA Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	0 - Traffic Channel not released during inactive periods (default).  1 - 255 - release the Traffic Channel after <value> 1 second intervals have elapsed since last sending or receiving RLP data frames on the Um interface.

**Example**

```

AT+MODE=0
OK
AT+CTA?
+CTA: 0

```



```

OK
AT+CTA=?
+CTA: (0-255)
OK
AT+CTA=59
OK
AT+CTA?
+CTA: 59
OK

```

## +CAD, Query Analog or Digital Service

This command queries the analog or digital service.

Command Type	Syntax	Response/Action
Read	AT+CAD?	+CAD: <value> or +CME ERROR <err>

The following table shows the CAD parameters.

**Table 3-173: +CAD Parameters**

<Parameter>	Description
<value>	0 - if no service is available 1 - if CDMA Digital service is available 2 - if TDMA Digital service is available 3 - if Analog service is available (values 4 to 255 reserved)

### Example

```

AT+CAD?
+CAD: 1
OK

```

## +CDR, Um Interface Data Compression Reporting

This command controls whether the extended-format +CDR: intermediate result code is transmitted by the MT2. The result code is the same as for the TIA/EIA/ IS-131 +DR: result code.

Command Type	Syntax	Response/Action
Set	AT+CDR=<n>	OK  or:  ERROR: <error_code>
Read	AT+CDR?	+CDR: <n> or +CME ERROR <err>
Test	AT+CDR=?	+CDR: (List of supported <n>s)

The following table shows the CDR parameters.

**Table 3-174: +CDR Parameters**

<Parameter>	Description
<n>	0 - Disable reporting 1 - Enable reporting

### Example

```
AT+CDR?  
+CDR: 0  
OK  
AT+CDR=?  
+CDR: (0-1)  
OK  
AT+CDR=1  
OK
```

## +CDS, Um Interface Data Compression

This command controls the V.42bis data compression function on the Um interface. The command format is the same as for the TIA/EIA/IS-131 +DS command.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CDS=<direction>, <compression_negotiation>, <max_dict>,<max_string>	<b>OK</b>  or:  <b>ERROR: &lt;error_code&gt;</b>
<b>Read</b>	AT+CDS?	+CDS: =<direction>, <compression_negotiation>, <max_dict>,<max_string>  or  +CME ERROR <err>
<b>Test</b>	AT+CDS=?	+CDS: (List of supported < direction >s), (List of supported < compression_negotiation >s), (List of supported < max_dict >s), (List of supported < max_string >s)
<b>Execute</b>	AT+CDS	Set to default (default is 0,1,2048,6)

The following table shows the CDS parameters.

**Table 3-175: +CDR Parameters**

<Parameter>	Description
<direction>	Specifies the desired directions of operations of the data compression function from the DTE's point of view.  0 Negotiated, no compression (V.42bis P0=0).
<compression_negotiation>	Specifies whether the DCE should continue to operate if the desired result is not obtained.  1 Disconnect if V.42 bis is not negotiated by the remote DCE as specified in <direction>.
<max_dict>	Specifies the maximum number of dictionary entries which should be negotiated.  512-65563
<max_string>	Specifies the maximum string length to be negotiated (V.42bis P2).  6-250

**Note:** Currently, QUALCOMM mobile does not support V.42bis compression. Mobile will only accept 0 as a valid setting.

**Example**

```
AT+CDS?
+CDS: 0,1,2048,6
OK
AT+CDS=?
+CDS: (0),(1),(512-65535),(6-250)
OK
AT+CDS=0,1,4096,250
OK
AT+CDS?
+CDS: 0,1,4096,250
OK
```

## +CRM, Set Rm Interface Protocol

This command enables set the protocol on the Rm interface.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CRM=<n>	OK  or:  ERROR: <error_code>
<b>Read</b>	AT+CRM?	+CRM: =<n>  or  +CME ERROR <err>
<b>Test</b>	AT+CRM=?	+CRM: (List of supported<n>s

The following table shows the CRM parameters.

**Table 3-176: +CRM Parameters**

<Parameter>	Description
<n>	0 - asynchronous data or fax 1 - packet data service, Relay Layer Rm interface 2 - packet data service, Network Layer Rm interface, PPP 3 - packet data service, Network Layer Rm interface, SLIP 4 - STU-III Service 5 to 127 - reserved for future use 128 to 255 - reserved for manufacturer-specific use  <b>Note:</b> The default value for the +CRM parameter will be 0 if this value is supported by the MT2. If 0 is not supported, the default +CRM value will be manufacturer-specific.

## +CQD, Command State Inactivity Timer

This command sets the timer value that specifies the period of inactivity before a Data call is released.

Command Type	Syntax	Response/Action
Set	AT+CQD=<n>	OK  or:  ERROR: <error_code>
Read	AT+CQD?	+CQD: =<n>  or  +CME ERROR <err>
Test	AT+CQD=?	+CQD: (List of supported<n>s

The following table shows the CQD parameters.

**Table 3-177: +CQD Parameters**

<Parameter>	Description
<n>	0 - ignored.  1 to 255 - release call after 5x<value> sec have elapsed without activity.  The default <value> shall be 10, corresponding to 50 sec.

### Example

```
AT+CQD?  
+CQD: 10  
OK  
AT+CQD=5  
OK
```

## +CMIP, Mobile Station IP Address

This command is used to display the mobile station's temporary IP address. The value displayed is in standard IP address format.

**Note:** This command returns an IP value only during a data call when a temporary IP address has been assigned. When not in a data call, this command returns "OK".

Command Type	Syntax	Response/Action
Read	AT+CMIP ?	+CMIP: xxx.xxx.xxx.xxx OK  or  ERROR: <error_code>

**Example**

AT+CMIP? //when IP address assigned  
+CMIP: 198.229.142.90  
OK

AT+CMIP? //when no IP address assigned  
+CMIP: 0.0.0.0  
OK

**+CBIP, Base Station IP Address**

This command is used to display the base station's temporary IP address. The value displayed is in standard IP address format.

**Note:** This command returns an IP value only during a data call when a temporary IP address has been assigned. When not in a data call, this command returns "OK".

Command Type	Syntax	Response/Action
Read	AT+CBIP?	+CBIP: xxx.xxx.xxx.xxx OK  or  ERROR: <error_code>

**Example**

AT+CBIP? //when IP address assigned  
+CBIP: 198.229.142.65  
OK

AT+CBIP? //when no IP address assigned  
OK

## +CMUX, Select Multiplex Option

This command Used to set the maximum number of multiplex options for the forward and reverse links for MDR (HSPD) calls.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CMUX=<Forward>,<Reverse>	OK  or:  ERROR: <error_code>
<b>Read</b>	AT+CMUX?	+CMUX: <Forward>,<Reverse>  or  +CME ERROR <err>
<b>Test</b>	AT+CMUX=?	+CMUX:(list of supported <Forward>s), (List of supported<Reverse>s)

The following table shows the CMUX parameters.

**Table 3-178: +CMUX Parameters**

<Parameter>	Description
<Forward>	(1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, F, 0)
<Reverse>	1 Multiplex Option 1 2 Multiplex Option 2



## +CFG, Configuration String

This command is used to set configuration string.

The string will be stored by the DCE and sent to the base station prior to dialing. Each transmission of an AT+CFG command from DTE replaces the contents of the previous string. The string may be up to 248 characters in length.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CFG= "Data"	OK  or:  ERROR: <error_code>
<b>Read</b>	AT+CFG?	+CFG: "data"

### Example

```
AT+CFG?
+CFG: ""
OK
AT+CFG="*43"
OK
AT+CFG?
+CFG: "*43"
OK
```

## +CXT, Cellular Extension

The command is used for cellular extension.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+CXT=<n>	OK  or:  ERROR: <error_code>
<b>Read</b>	AT+CXT?	+CXT: n
<b>Test</b>	AT+CXT=?	+CXT: (List of supported<n >s),

The following table shows the CXT parameters.

**Table 3-179: +CMUX Parameters**

<Parameter>	Description
<n>	0 - do not pass unrecognized commands to the IWF (default).  1 - when detecting an unrecognized AT command, open transport layer connection and pass unrecognized command to the IWF.

### Example

```
AT+CXT?
+CXT: 0
OK
AT+CXT=?
+CXT: (0-1)
OK
AT+CXT=1
OK
```

### +MV18S, V.18 Selection

This command controls the manner of operation of the V.18 capabilities (if present in the IWF).

Command Type	Syntax	Response/Action
Set	AT+MV18S=[<mode>[,<dflt_ans>[,<fbk_time_enable>]]]	OK  or:  ERROR: <error_code>
Read	AT+MV18S?	+MV18S:<mode>,<dflt_ans_mode>,<fbk_time_enable> OK
Test	AT+MV18S=?	+MV18S: (List of supported<mode>s), (List of supported<dflt_ans>s), (List of supported <fbk_time_enable>s)

The following table shows the MV18S parameters.

**Table 3-180: +MV18S Parameters**

<Parameter>	Description
<mode>	0 Disables V.18 operation 1 V.18 operation, auto detect mode 2 V.18 operation, connect in 5-bit mode 3 V.18 operation, connect in DTMF mode 4 V.18 operation, connect in EDT mode 5 V.18 operation, connect in V.21 mode 6 V.18 operation, connect in V.23 mode 7 V.18 operation, connect in Bell 103-type mode
<dflt_ans>	0 Disables V.18 answer operation 1 no default specified (auto detect) 2 V.18 operation connect in 5-bit mode 3 V.18 operation connect in DTMF mode 4 V.18 operation connect in EDT mode
<fbk_time_enable>	0 Disable 1 Enable

#### Example

```

AT+MV18S?
+MV18S: 0,0,0
OK
AT+MV18S=7,4,1
OK
  
```

## +MV18R, V.18 Reporting Control

This command controls whether the extended-format +MV18R: result code is transmitted from the IWF to the mobile station.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+MV18R=<n>	<b>OK</b>  <b>or:</b>  <b>ERROR: &lt;error_code&gt;</b>
<b>Read</b>	AT+MV18R?	+MV18R:<n> <b>OK</b>
<b>Test</b>	AT+MV18R=?	+MV18R: (List of supported<n>s)

The following table shows the MV18R parameters.

**Table 3-181: +MV18R Parameters**

<Parameter>	Description
<n>	0 Disables reporting of V.18 connection 1 Enable reporting of V.18 connection

#### Example

```
AT+MV18R?
+MV18R: 1
OK
AT+MV18R=0
OK
```

## +MS, Modulation Selection

This command controls the manner of operation of the modulation capabilities in the IWF.

## +ETBM, Data Handling

This extended command controls the handling of data remaining in IWF buffers upon service termination.

Command Type	Syntax	Response/Action
<b>Set</b>	AT+ETBM=[<pending_TD>[,<pending_RD>[,<timer>]]]	OK  or  ERROR: <error_code>  In case AT+ETBM= is set without value, the default value will be set.
<b>Read</b>	AT+ETBM?	+ETBM:<pending_TD>,<pending_RD>,<timer> OK
<b>Test</b>	AT+ETBM=?	+ETBM: (List of supported< pending_TD >s), (List of supported< pending_RD >s), (List of supported< timer >)

The following table shows the ETBM parameters.

**Table 3-182: +ETBM Parameters**

<Parameter>	Description
<pending_TD>	<p>0 Discard all buffered data immediately and disconnect.</p> <p>1 Attempt delivery until all data is delivered and acknowledged (ignore timer). If the remote DCE disconnects, discard the remaining data.</p> <p>2 Attempt delivery until all data is delivered and acknowledged. If the timer expires or the remote DCE disconnects, discard the remaining data.</p> <p>Default value is 1.</p>
<pending_RD>	<p>0 Discard all buffered data immediately and disconnect.</p> <p>1 Attempt delivery until all data is delivered and acknowledged (ignore timer). If the local DTE disconnects, discard the remaining data.</p> <p>2 Attempt delivery until all data is delivered. If the timer expires or the local DTE disconnects, discard the remaining data.</p> <p>Default Value is 1</p>
<timer>	<p>Sets a maximum time limit on how long the DCE will attempt to deliver the buffered data before abandoning the attempt and discarding the remaining data.</p> <p>0-30 Delivery time in seconds. Other Higher values may be supported.</p> <p>Default value is 20.</p>

### Example

```

AT+ETBM?
+ETBM: 1,1,20
OK
AT+ETBM=1,1,30
OK
AT+ETBM?
+ETBM: 1,1,30
OK

```

## +ESR, Selective Repeat Option Controller

This command controls the use of the selective repeat (SREJ) option in V.42 on the PSTN link (if present in the IWF).

Command Type	Syntax	Response/Action
Set	AT+ESR=[<n>]	OK  or  ERROR: <error_code>  In case AT+ESR= is set without value, the default value will be set.
Read	AT+ESR?	+ESR:<n> OK
Test	AT+ESR=?	+ESR: (List of supported<n>s)

The following table shows the ESR parameters.

**Table 3-183: +ESR Parameters**

<Parameter>	Description
<n>	0 Do not use SREJ. 1 Use SREJ if available in remote DCE. If not, continue without it. 2 Use SREJ if available in remote DCE. If not, disconnect.  Default value is 1.

### Example

```
AT+ESR?  
+ESR: 2  
OK  
AT+ESR=1  
OK  
AT+ESR?  
+ESR: 1  
OK
```

## +ES, Error Control Selection

This command controls the manner of operation of the V.42 protocol on the PSTN link (if present in the IWF).

Command Type	Syntax	Response/Action
Set	AT+ES=[<orig_rqst>[,<orig_fbk>[,<ans_fbk>]]]	OK  or  ERROR: <error_code>  In case AT+ES= is set without values, the default values will be set.
Read	AT+ES?	+ES:< orig_rqst >,< orig_fbk >,< ans_fbk > OK
Test	AT+ES=?	+ES: (List of supported< orig_rqst >s), (List of supported< orig_fbk >s), (List of supported< ans_fbk >)

The following table shows the ES parameters.

**Table 3-184: +ES Parameters**

<Parameter>	Description
<orig_rqst>	0 Direct mode 1 Initiate call with Buffered mode only 2 Initiate V.42 without Detection Phase. 3 Initiate V.42 with Detection Phase 4 Initiate Alternative Protocol  Default value is 3.

**Table 3-184: +ES Parameters (Cont.)**

<Parameter>	Description
<orig_fbk>	<p>0 Error control optional (either LAPM or alternative acceptable). If error control is not established, maintain DTE-DCE data rate and use V.14 buffered mode with flow control during non-error-control operation.</p> <p>1 Error control optional (either LAPM or alternative acceptable). If error control is not established, change the DTE-DCE data rate to match the line rate and use Direct mode.</p> <p>2 Error control required (either LAPM or alternative acceptable). If error control is not established, disconnect.</p> <p>3 Error control required (only LAPM acceptable). If error control is not established, disconnect.</p> <p>4 Error control required (only alternative acceptable). If error control is not established, disconnect.</p> <p>Default value is 0.</p>
<ans_fbk>	<p>0 Direct mode.</p> <p>1 Error control disabled, use Buffered mode.</p> <p>2 Error control optional (either LAPM or alternative acceptable). If error control is not established, maintain the DTE-DCE data rate and use the V.14 buffered mode with flow control during non-error-control operation.</p> <p>3 Error control optional (either LAPM or alternative acceptable). If error control is not established, change the DTE-DCE data rate to match the line rate, and use Direct mode.</p> <p>4 Error control required (either LAPM or alternative acceptable). If error control is not established, disconnect.</p> <p>5 Error control required (only LAPM acceptable). If error control is not established, disconnect.</p> <p>6 Error control required (only alternative acceptable). If error control is not established, disconnect.</p> <p>Default value is 2.</p>

## +ER, Error Control Reporting

This command controls whether the extended-format +ER: intermediate result code is transmitted from the IWF over the Um interface.

Command Type	Syntax	Response/Action
Set	AT+ER=[<n>]	<p>OK</p> <p>or</p> <p>ERROR: &lt;error_code&gt;</p> <p>In case AT+ER= is set without value, the default value will be set.</p>



Command Type	Syntax	Response/Action
Read	AT+ER?	+ER:<n> OK
Test	AT+ER=?	+ER: (List of supported<n>s)

The following table shows the ER parameters.

**Table 3-185: +ER Parameters**

<Parameter>	Description
<n>	0 Error control reporting disabled. 1 Error control reporting enabled.  Default value is 1.

## +DS, Data Compression

This command controls the V.42bis data compression function on the PSTN link if provided in the IWF.

Command Type	Syntax	Response/Action
Set	AT+DS=[<direction>[, <compression_negotiation>[, <max_dict>,<max_string>]]]	OK  or  ERROR: <error_code>  In case AT+DS= is set without values, the default values will be set.
Read	AT+DS?	+DS: =<direction>, <compression_negotiation>, <max_dict>,<max_string>  or  +CME ERROR <err>
Test	AT+DS=?	+DS: (List of supported < direction >s), (List of supported < compression_negotiation >s), (List of supported < max_dict >s), (List of supported < max_string >s)
Execute	AT+DS	Set to default.

The following table shows the DS parameters.

**Table 3-186: +DS Parameters**

<Parameter>	Description
<direction>	Specifies the desired direction of operations of the data compression function from the DTE's point of view.  0 Negotiated, no compression (V.42bis P0=0). 1 Transmit only. 2 Receive only. 3 Both directions, accept any direction.  Default is 3.
<compression_negotiation>	Specifies whether the DCE should continue to operate if the desired result is not obtained.  0 Do not disconnect if V.42 bis is not negotiated by the remote DCE as specified in <direction>.
<max_dict>	Specifies the maximum number of dictionary entries which should be negotiated.  512-2048  Default is determined by the manufacturer.
<max_string>	Specifies the maximum string length to be negotiated (V.42bis P2).  Default and only value is 6.

### Example

```
AT+DS?  
+DS: 3,0,2048,6  
OK  
AT+DS=1,0,2048,6  
OK  
AT+DS?  
+DS: 1,0,2048,6  
OK
```

## +DR, Data Compression Reporting

This command controls whether the extended-format +DR: intermediate result code is transmitted from the IWF over the Um interface.

If data reporting is enabled, this command returns the data compression type of an incoming or outgoing data call. Otherwise, the command returns NONE.

Command Type	Syntax	Response/Action
<b>Set</b>	<b>AT+DR=&lt;n&gt;</b>	<b>OK</b>  <b>The intermediate result code represents data compression type. The syntax for +DR reporting is: +DR&lt;result&gt;</b>  <b>or</b>  <b>ERROR: &lt;error_code&gt;</b>
<b>Read</b>	<b>AT+DR?</b>	<b>+DR: =&lt;n&gt;</b>  <b>or</b>  <b>+CME ERROR &lt;err&gt;</b>
<b>Test</b>	<b>AT+DR=?</b>	<b>+DR: (List of supported &lt;n&gt;s)</b>

The following table shows the DR parameters.

**Table 3-187: +DR Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	0 Disable reporting 1 Enable reporting
<b>&lt;result&gt;</b>	<b>+DR:NONE</b> - Data compression is not in use. <b>+DR:V42B</b> - V.42bis is in use in both directions. <b>+DR:V42B RD</b> - V.42bis is in use in receive direction only. <b>+DR:V42B TD</b> - V.42bis is in use in transmit direction only.

## +EFCS, FCS Values

This command controls the use of the 32-bit frame check sequence option in V.42 on the PSTN link (if present in the IWF).

Command Type	Syntax	Response/Action
<b>Set</b>	AT+EFCS=<value>	OK  or  ERROR: <error_code>
<b>Read</b>	AT+EFCS?	+EFCS: =<value>  or  +CME ERROR <err>
<b>Test</b>	AT+EFCS=?	+EFCS: (List of supported <value>s)

The following table shows the FCS parameters.

**Table 3-188: +EFCS Parameters**

<Parameter>	Description
<value>	0 Use 16 bit FCS. 1 Use 32-bit FCS, if available in the remote DCE, otherwise use 16-bit FCS. 2 Use 32-bit FCS if available in the remote DCE.

## \$QCSCRM, Enable/Disable Mobile from SCRM'ing

This command enables/disables the mobile from SCRM'ing (SCRM, Supplemental Channel Request Message).

Command Type	Syntax	Response/Action	Remarks
<b>Execute</b>	\$QCSCRM	OK	This command sets the SCRM to default value (1).
<b>Set</b>	\$QCSCRM=<n>	OK or: +CME ERROR: <err>	The command enables/disables the mobile from SCRM'ing Command only applies to SO 33 calls. This value is stored in NV.

Command Type	Syntax	Response/Action	Remarks
Read	\$QSCRM?	\$QSCRM:<n>	The Read command returns the current setting of <n>.
Test	\$QSCRM=?	\$QSCRM: (list of supported <n>'s)	

The following table shows the \$QSCRM parameters.

**Table 3-189: \$QSCRM Parameters**

<Parameter>	Description
<n>	0 Mobile never SCRM. 1 Mobile can SCRM as needed.

#### Example

```
AT$QSCRM?
$QSCRM: 1
OK
AT$QSCRM=0
OK
```

### \$QCMDR, Set Medium Data Rate (MDR) (HSPD) Setting

This command sets the Medium Data Rate (MDR) (also known as HSPD) setting.

If \$QCMIP=1 then MDR mode is always set to "3" (SO 33 if available).

Command Type	Syntax	Response/Action	Remarks
Set	\$QCMDR=<mdr>	OK or: +CME ERROR: <err>	The command set the MDR mode.
Read	\$QCMDR?	\$QCMDR:<mdr>	The Read command returns the current setting of <mdr>.
Test	\$QCMDR =?	\$QCMDR: (list of supported <mdr>'s)	

The following table shows the \$QCMDR parameters.

**Table 3-190: \$QCMDR Parameters**

<Parameter>	Description
<mdr>	<p>0 - MDR Service Only. The mobile will originate with SO 22 or SO 25. The mobile will not negotiate to any other service option if SO 22 and SO 25 are unavailable.</p> <p>1 - MDR Service, if available. The mobile will originate with SO 22 or SO 25, but will negotiate to a Low-Speed Packet service option if MDR is not available. The mobile will not negotiate to SO 33.</p> <p>2 - SPD only. The mobile will originate a Low-Speed Packet call only. The mobile will not negotiate to SO 22, SO 25, or SO 33.</p> <p>3 - SO 33, if available. The mobile will negotiate to MDR or Low-Speed Packet service options if SO 33 is not available.</p>

### Example

```

AT$QCMDR?
$QCMDR: 3
OK
AT$QCMDR=2
OK

```

## \$QCDMR, Set DM Baud Rate

This command sets the DM baud rate (for use with Diagnostic Monitor only such as QXDM).

Command Type	Syntax	Response/Action	Remarks
Set	\$QCDMR=<DM baud rate>	OK or: +CME ERROR: <err>	The command set the DM baud rate values.
Read	\$QCDMR?	\$QCDMR: <DM baud rate>	The Read command returns the current value of <DM baud rate>.
Test	\$QCDMR =?	\$QCDMR: (list of supported <DM baud rate>'s)	

The following table shows the \$QCDMR parameters.

**Table 3-191: \$QCDMR Parameters**

<Parameter>	Description
<DM baud rate>	19200 38400 57600 115200 230400

### Example

```
AT$QCDMR=38400
OK
AT$QCDMR?
AT$QCDMR: 38400
OK
```

## +GOI, Device Identification

This command causes the MT2 to transmit one or more lines of information text, determined by the manufacturer, which permit the MT2 user to identify the device, based on the ISO system for registering unique object identifiers. Typically, the text consists of a single line containing numeric strings delimited by period characters.

Command Type	Syntax	Response/Action
Execute	+GOI	+GOI: Motorola/C24 OK

# Audio

## Scope

The audio control can be Summarized to the following three topics:

- Path: Selection of microphone and speaker to be used.
- Gain: Control of volume levels for rings, voice, etc.
- Algorithm: Activation of audio algorithms (echo suppression, noise suppression and sidetone).

The C24 incorporates two audio modes: 'Basic Audio' and 'Advanced Audio'. Each mode has a different behavior and a set of relevant AT commands. [Figure 3-10](#) describes the two audio modes, switching between them and the AT commands related to each mode.

Audio Control of Path, Gain and Algorithms is available by these two different modes' sets of commands. It is advised to select the audio mode according to the application needs, either the 'Basic Audio' set or the 'Advanced Audio' set.

### Basic Audio

This mode of commands suits most users. It provides a simple audio control. In this mode the C24 will also adjust the paths automatically upon headset interrupt. The C24 powers up in 'Basic Audio' mode.

Basic audio specific commands are: +CRSL, +CLVL, +CMUT, S94, S96.

### Advanced Audio

This mode suits users who require a full control of the audio. When using these advanced commands, the audio control will ignore the headset interrupt (when the headset will be connected the paths will not change automatically). Upon invoking, any of the advanced Audio specific commands: +MAVOL, +MAPATH, +MAFEAT, +MAMUT, the C24 enters 'Advanced Audio' mode. C24 remains in 'Advanced audio' mode until the next power up.

While in Advanced Mode, all Basic Audio AT commands (+CRSL, +CLVL, +CMUT, S94, S96) are blocked and will return an error.

### General Audio Commands

The following audio commands can be used in both Basic and Advanced audio modes:

+CRTT, +VTD, +VTS, +CALM, +MMICG, +MADIGITAL



Table 3-192 shows the differences between Basic and Advanced audio modes in controlling the audio.

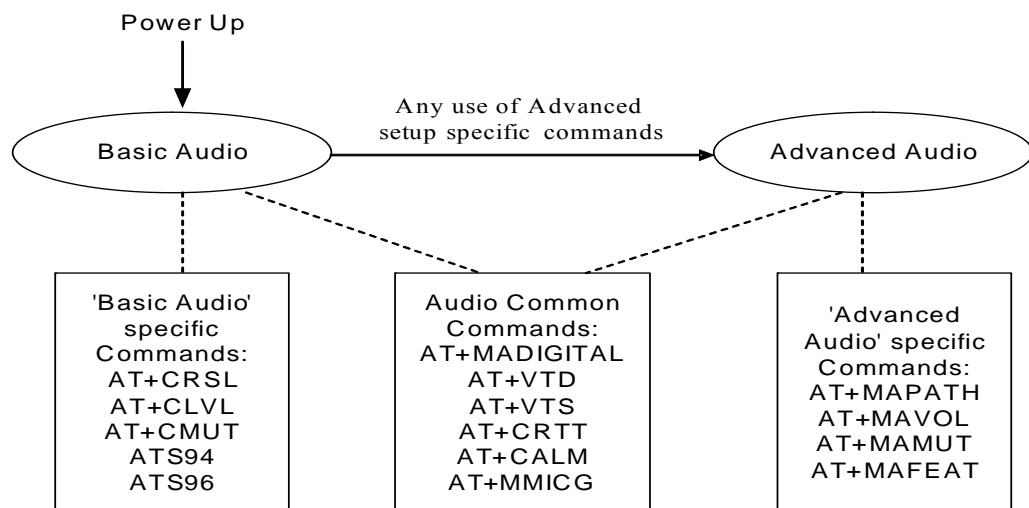
**Table 3-192: Basic and Advanced Audio Modes Comparison**

	Basic Audio	Advanced Audio
<b>Path</b>	Paths are set automatically (upon interrupt).	Paths are set manually. All routings are available; any microphone with any speaker for each type of sound (voice, keyfeedbacktone, Internal Tones, rings/alerts, etc.).
<b>Gain</b>	There are two types of gains: voice, Internal Tones and rings/alerts.	There is a matrix of gains: a different gain is saved for each type of sound through a specific speaker. For example, one volume level for rings through the speaker and a different volume level for rings through the transducer. Therefore, there will be 16 different volume levels, which is the product of the number of output accessories (speaker, headset speaker, transducer and digital output) and the number of audio tones (voice, keyfeedbacktone, Internal Tones, rings/alerts).
<b>Algorithm</b>	Algorithms are set by ATS94 and ATS96.	Algorithms are set by AT+MAFEAT.

## Audio Setup

The C24 has two audio modes: 'Basic Audio' and 'Advanced Audio'. Each mode has a different behavior and a set of relevant AT commands.

Figure 3-9 describes the two audio modes, switching between them and the AT commands related to each mode.



**Figure 3-9: Audio Modes**

Audio Control of Path, Gain and Algorithms is available by these two different modes' sets of commands. It is advised to select the audio mode according to the application needs, either the 'Basic Audio' set or the 'Advanced Audio'.

## Basic Audio Setup

This mode's set of commands suits most users. It provides a simple audio control. In this mode the C24 will also adjust the paths automatically upon headset interrupt. The C24 powers up in 'Basic Audio' mode.

Basic audio specific commands are: +CRSL, +CLVL, +CMUT, S94, S96.

Figure 3-10 shows the basic audio setup.

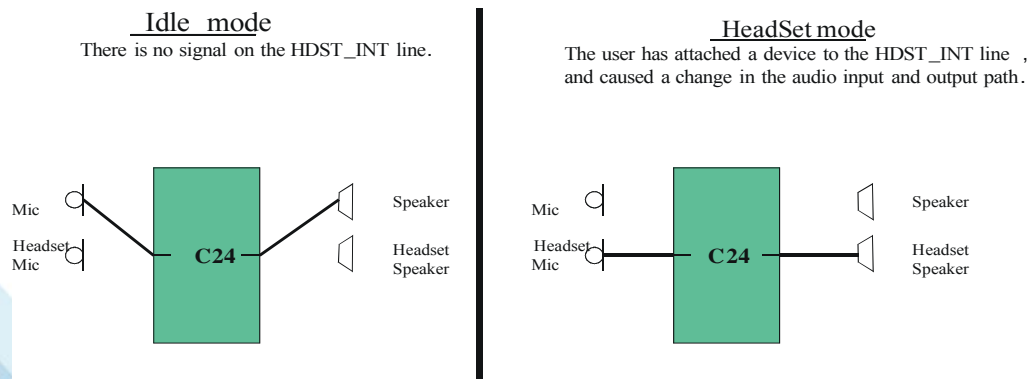


Figure 3-10: Basic Audio Setup

## Advanced Audio Setup

This mode suits users which require a full control of the audio. When using these advanced commands the audio control will ignore the headset interrupt (when the headset will be connected the paths will not change automatically). Upon invoking any of the advanced Audio specific commands: +MAVOL, +MAPATH, +MAFEAT, +MAMUT the C24 will enter 'Advanced Audio' mode. C24 will remain in 'Advanced audio' mode until power cycle.

While in Advanced Mode, all Basic Audio AT commands (+CRSL, +CLVL, +CMUT, S94, S96) are blocked and will return an error.

Figure 3-11 shows the advanced setup.

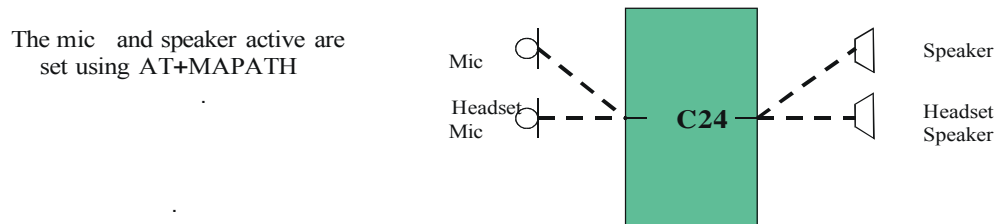


Figure 3-11: Advanced Audio Setup

C24 supports both analog and digital audio. Digital audio is supported in both basic and advanced audio setups. Switching between analog and digital audio modes is done by AT+MADIGITAL command. The default state is analog.

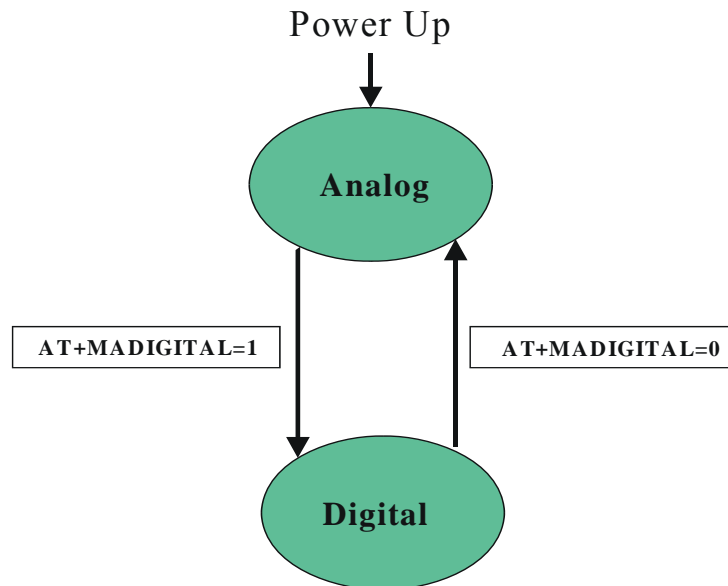


Figure 3-12: Analog/Digital Switching

## General Audio Commands

The following audio commands can be used in both Basic and Advanced audio modes.

General audio commands are: +CRTT, +VTD, +VTS, +CALM, +MMICG, +MADIGITAL.

## Basic Audio Setup Commands

### +CRSL, Call Ringer Level

This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the C24. The new value remains after power cycle. This command has no affect on digital audio mode.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CRSL=<level>	OK +CME ERROR: <err>	The Set command sets the call ringer level.
<b>Read</b>	+CRSL?	+CRSL: <level> +CME ERROR: <err>	The Read command displays the call ringer level.
<b>Test</b>	+CRSL=?	+CRSL: (list of supported <level>s) +CME ERROR: <err>	The Test command displays the list of supported sound level settings.

The following table shows the +CRSL parameters.

**Table 3-193: +CRSL Parameters**

<Parameter>	Description
<level>	0 Mute 1-7 Ringer sound level (1 is lowest; 7 is default after flex)

#### Example

```
AT+CRSL?  
+CRSL: 7  
OK  
AT+CRSL=?  
+CRSL: (0-7)  
OK  
AT+CRSL=5  
OK
```

#### +CLVL, Loudspeaker Volume

This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the C24.

**Note:** The +CLVL command does not control the alert speaker.

In this command, the new value remains after power cycle.

The +CLVL command can be used even when the R-UIM is not inserted. This command has no affect on digital audio mode.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CLVL=<level>	OK +CME ERROR: <err>	The Set command sets the internal loudspeaker volume level.
<b>Read</b>	+CLVL?	+CLVL: <level> +CME ERROR: <err>	The Read command displays the current internal loudspeaker volume setting.
<b>Test</b>	+CLVL=	+CLVL: (list of supported <level>s) +CME ERROR: <err>	The Test command displays the possible loudspeaker volume settings.

The following table shows the +CLVL parameters.

**Table 3-194: +CLVL Parameters**

<Parameter>	Description
<level>	0-7 Manufacturer-specific volume range. 0 is lowest volume (not mute). The default value is 7 after flex.

#### Example

```
AT+CLVL?
+CLVL: 7
OK
AT+CLVL=?
+CLVL: (0-7)
OK
AT+CLVL=3
OK
```

### +CMUT, Mute/Unmute Currently Active Microphone Path

This command is used to mute/unmute the currently active microphone path by overriding the current mute state.

**Note:** State returns to unmute automatically after call is released; this command is active command per one call.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CMUT=<state>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command enables/disables uplink voice muting during a voice call.
<b>Read</b>	+CMUT?	+CMUT: <state> <b>OK</b>	The Read command returns the current uplink voice mute/unmute state.
<b>Test</b>	+CMUT=?	+CMUT: (list of supported <state>s) <b>OK</b>	The Test command returns the possible <state> values.

The following table shows the +CMUT parameters.

**Table 3-195: +CMUT Parameters**

<Parameter>	Description
<state>	0 Unmute microphone path 1 Mute microphone path

**Example**

```

AT+CMUT=?
+CMUT:(0-1)
OK
// setup a voice call
AT+CMUT?
+CMUT: 0                //uplink voice is unmuted
OK

AT+CMUT=1                //uplink voice is muted
OK
AT+CMUT?
+CMUT: 1
OK
// call release
AT+CMUT?
+CMUT: 0
OK

AT+CMUT =2
+CME ERROR: <err>

```

**S94, Sidetone Effect**

This command reduces the microphone audio input that is routed to the selected speaker, so that people speaking will hear themselves talking (The default value of S94 is "1").

The following table explains the use of the ATS94 set.

**Table 3-196: ATS94 and ATS96 Behavior**

ATS94	ATS96	Echo Cancel	Noise Suppress	ST
0	0	Disabled	Disabled	Disabled
1	0	Disabled	Disabled	Enabled
0	1	Enabled	Enabled	Disabled
1	1	Enabled	Enabled	Disabled

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATS94=<n>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the sidetone status.

Command Type	Syntax	Response/Action	Remarks
<b>Read</b>	ATS94?	<000-disabled, 001-enabled> OK or: +CME ERROR: <err>	The Read command returns the sidetone status.
<b>Test</b>	ATS94=?	ATS94 :(list of supported <n>s) OK	The Test command displays the supported values of <n>.

The following table shows the S94 parameters.

**Table 3-197: S94 Parameters**

<Parameter>	Description
<n>	0     Disable sidetone 1     Enable sidetone On power up the sidetone is enabled.

#### Example

```

ATS94=0           //Disable sidetone
OK
ATS94=2
+CME ERROR: <err>
ATS94?
000              //Sidetone disabled
OK

```

## S96, Echo Suppressing

This command suppresses a large amount of the output sound picked up by the input device (Suppress all echo). S96 value is saved in the Flex.

The following table explains the use of the ATS96 set.

**Table 3-198: ATS96 and ATS94 Behavior**

ATS96	ATS94	Echo Suppress	Noise Suppress	ST
0	0	Disabled	Disabled	Disabled
0	1	Disabled	Disabled	Enabled
1	0	Enabled	Enabled	Disabled
1	1	Enabled	Enabled	Disabled

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	ATS96=<n>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the echo Suppression status and noise suppression status.
<b>Read</b>	ATS96?	<b>&lt;000-disabled, 001-enabled&gt;</b> <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Read command returns the echo suppression status and noise suppression status.
<b>Test</b>	ATS96=?	<b>ATS96 :(list of supported &lt;n&gt;s)</b> <b>OK</b>	The Test command displays the supported values of <n>.

The following table shows the S96 parameters.

**Table 3-199: S96 Parameters**

<Parameter>	Description
<n>	0    Disable echo and noise suppression 1    Enable echo and noise suppression

#### Example

```

ATS96=1                //Enable echo canceling
OK
ATS96=4
+CME ERROR: <err>
ATS96?
001                    //Echo suppression enabled
OK

```

## Advanced Audio Setup Commands

This group of commands enables accessory devices to control certain audio aspects within the system.

### +MAPATH, Audio Path

This command sets/requests the active input accessory, and the output accessory for each feature. For example, you can choose the headset mic to be active, the voice and Internal Tones to go to the speaker, Keyfeedback tone and the alerts to go to the alert speaker. On power up, the default path, mic, speaker and alert speaker are restored.

**Note:** +MAPATH cannot be used to set digital audio, but only to read it. In order to set the digital audio path, use +MADIGITAL. For more information, refer to section “+MADIGITAL, Analog/Digital Audio Switching” on page 3-313.



The following diagram shows the audio paths:.

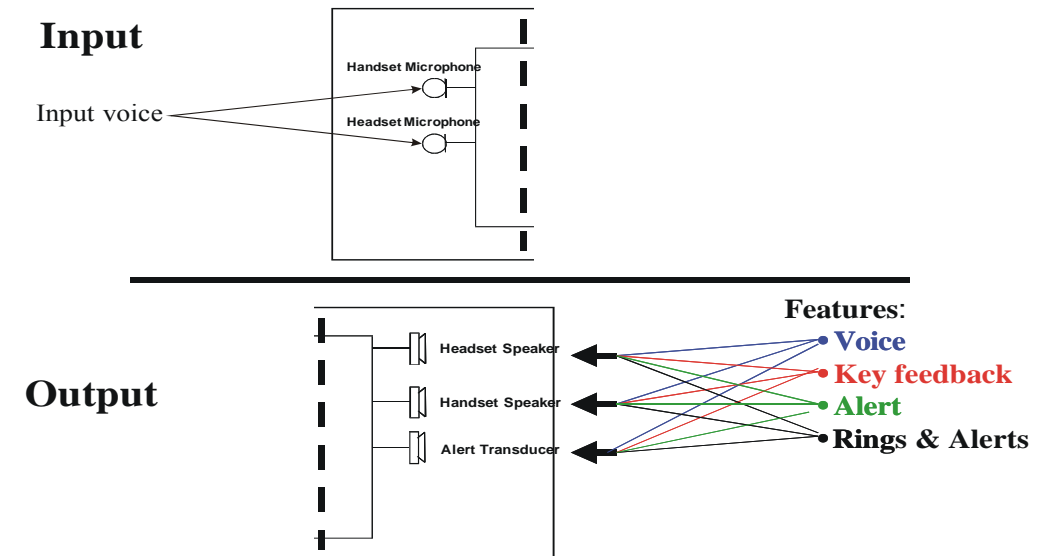


Figure 3-13: Audio Paths

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MAPATH= <direct>,<accy> [,<features>]	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the audio path mode. The mode indicates which I/O accessories are now active for the different audio features. The <features> field is only used for outputs (direct=2).
<b>Read</b>	+MAPATH?	<b>+MAPATH:1(mode in),&lt;accy&gt;</b> <b>+MAPATH:2(mode out),&lt;accy&gt;,&lt;feature&gt;</b> [<CR><LF>+MAPATH:2 (mode out),<accy>,<feature> [...]] <b>OK</b>	The Read command returns the active input audio accessory and the output accessory for each feature.
<b>Test</b>	+MAPATH=?	<b>+MAPATH: (list of supported directions),(list of supported accessories),(list of supported features combinations)</b> <b>OK</b>	The Test command returns the supported audio directions (input/output), accessories and features.

The following table shows the +MAPATH parameters.

**Table 3-200: +MAPATH Parameters**

<Parameter>	Description
<direct>	1 Mode in, field <features> is ignored. 2 Mode out, field <features> is present.
<accy>	Mode in: 1 Mic 2 Headset mic 3 Digital RX (for read command only) Mode out: 1 Speaker 2 Headset speaker 3 Alert speaker, for example, battery low, incoming SMS, power up, and so on 4 Digital TX (for read command only)
<features> (1-15)	1 Voice 2 Keyfeedback tone (DTMF back tone) 4 Internal Tones (Busy tone, ring back tone, Confirm tone etc.) 8 Alert (MT call Ring, SMS Alert etc.)

### Example

```

AT+MAPATH=1,2           //Direct=1 (input), accy=2 (headset mic)
OK

AT+MAPATH=2,1,3         //Direct=2 (output), accy=1 (speaker), feature=1 (voice and
Keyfeedback tone)
OK

AT+MAPATH?              //Set the headset mic as the input accessory
MAPATH: 1,2             //Direct=1 (input), accy=2 (headset mic)
MAPATH: 2,1,1           //Direct=2 (output), accy=1 (speaker), feature=1 (voice)
MAPATH: 2,1,2           //Direct=2 (output), accy=1 (speaker), feature=2 (Keyfeedback) to
delete 2,1,2
MAPATH: 2,3,4           //Direct=2 (output), accy=3 (alert speaker), feature=4 (Internal Tones)
MAPATH: 2,3,8           //Direct=2 (output), accy=3 (alert speaker), feature=8 (Alert)
OK

AT+MAPATH=?
+MAPATH: (1,2),(1-4),(1-15)
OK

```

### +MAVOL, Volume Setting

This command enables you to determine a volume level for a particular feature via a particular accessory. The gain levels are saved in flex. Therefore, upon power up, the path active (mic,

speaker and alert speaker) will have these saved gain levels. This command is applicable for Analog and Digital mode as well.

**Note:** The SMS MT volume is adjusted using the +MAVOL command with type "alert". The alert value is related to the SMS alert, the MT call, and so on.

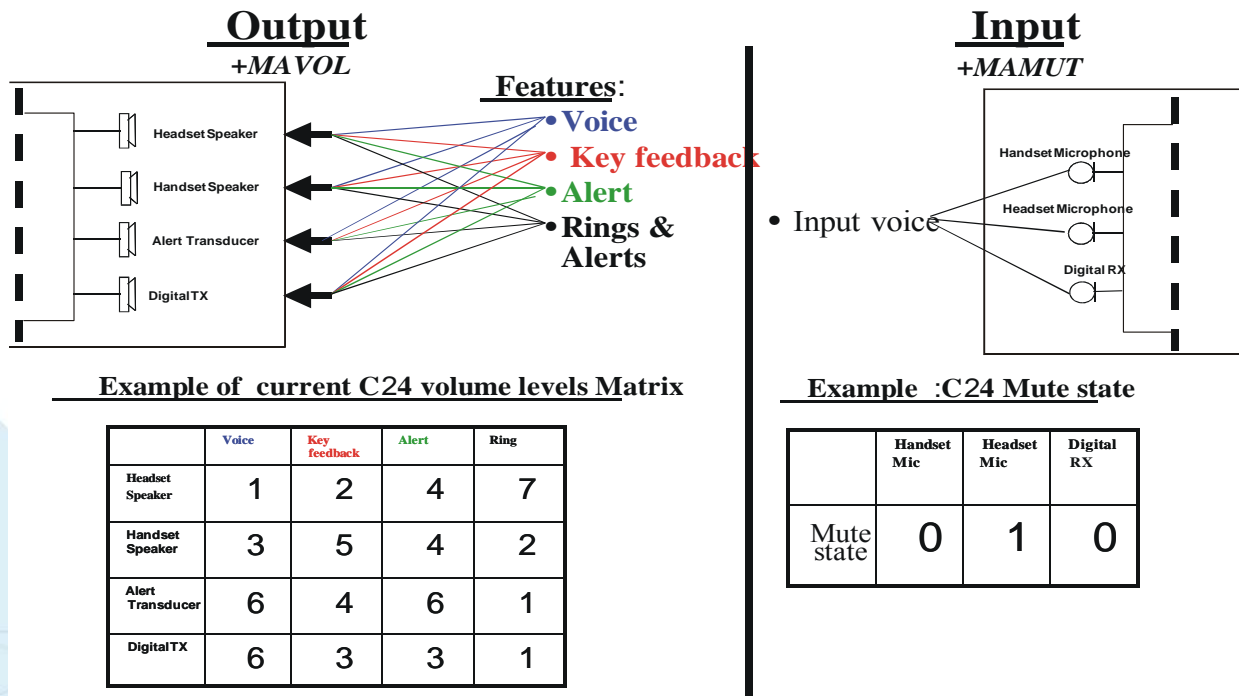


Figure 3-14: C24 Audio Gain

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MAVOL=<accy>,<feature>,<vol>	OK or: +CME ERROR: <err>	The Set command sets the volume level <n> to a certain <feature> through a certain <accy>.
<b>Read</b>	+MAVOL?	(Current path volume) +MAVOL: <accy>,<feature1>,<vol> +MAVOL: <accy>,<feature2>,<vol> +MAVOL: <accy>,<feature4>,<vol> +MAVOL: <accy>,<feature8>,<vol> OK	The Read command returns the volume level of all the features in the current active accessories.
<b>Test</b>	+MAVOL=?	+MAVOL:(supported accessories),(supported features combinations),(supported volume levels)	Test command returns the supported range of volume levels, accessories and features.

The following table shows the +MAVOL parameters.

**Table 3-201: +MAVOL Parameters**

<Parameter>	Description
<accy> (1-15)	1 Speaker 2 Headset speaker 4 Alert speaker 8 Digital TX
<feature> (1-15)	1 Voice 2 Keyfeedback tone (DTMF back tone) 4 Internal Tones (Busy tone, ring back tone, Confirm tone etc.) 8 Alert (MT call Ring, SMS Alert etc.)
<vol>	Volume level 0-7

### Example

```
//Set volume level 3 for voice through speaker
AT+MAVOL=1,1,3           //Accy=1 (speaker), feature=1 (voice), vol=3 (volume level)
OK
//Set volume level 5 for voice and keypad through speaker
AT+MAVOL=1,5,5           //Accy=1 (speaker), feature=5 (voice and Internal Tones), vol=5
                           (volume level)
OK
AT+MAVOL?                //Requests the volume level of the current path's features
//Currently the voice outputs through speaker and its volume level is 5
+MAVOL: 1,1,5            //Accy=1 (speaker), feature=1 (voice), vol=5
//Currently the keypad outputs through speaker and its volume level is 5
+MAVOL: 1,2,5            //Accy=1 (speaker), feature=2 (Keyfeedback), vol=5
//Currently the alert outputs through alert speaker and its volume level is 2
+MAVOL: 4,4,2            //Accy=4 (alert speaker), feature=4 (Internal Tones), vol=2
//Currently the ring outputs through alert speaker and its volume level is 2
+MAVOL: 4,8,2            //Accy=4 (alert speaker), feature=8 (Alert), vol=2
OK
```

## +MAMUT, Input Devices Mute

This command controls the muting/unmuting of all input paths (mic, headset mic or digital RX). Upon power up, all the devices are unmuted.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MAMUT=<accy>,<state>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command mutes/unmutes any input accessory or any combination of them.
<b>Read</b>	+MAMUT?	+MAMUT:<accy1>,<state> +MAMUT:<accy2>,<state> +MAMUT:<accy4>,<state> <b>OK</b>	The Read command returns the current mute/unmute state of all the input accessories.
<b>Test</b>	+MAMUT=?	+MAMUT:(<accy> range),(<state> range)	The Test command returns the mute states available and the output accessories supported.

The following table shows the +MAMUT parameters.

**Table 3-202: MAMUT Parameters**

<Parameter>	Description
<accy> (1-7)	1 Mic 2 Headset mic 4 Digital RX
<state>	0 Unmute 1 Mute

### Example

```
AT+MAMUT=2,0           //Accy=2 (headset mic), state=0 (unmute)
OK
```

```
AT+MAMUT=5,1           //Accy=5 (mic + Digital RX), state=1 (mute)
OK
```

```
AT+MAMUT?
+MAMUT: 1,1           //Accy=1 (mic), state=1 (mute)
+MAMUT: 2,0           //Accy=2 (headset mic), state=0 (unmute)
+MAMUT: 4,1           //Accy=4 (Digital RX), state=1 (mute)
```

```
AT+MAMUT=?
+MAMUT: (1-7),(0,1)
OK
```

## +MAFEAT, Features Selection

This command controls the algorithm features: sidetone, echo cancel and noise suppression. Upon power up, the sidetone is enabled, and echo canceling and noise suppression are disabled.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MAFEAT=<feature>,<state>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command enables/disables feature combinations.
<b>Read</b>	AT+MAFEAT?	<b>+MAFEAT:</b> <b>&lt;feature&gt;&lt;state&gt;</b> , [<CR><LF>+MAFEAT: <b>&lt;feature&gt;&lt;state&gt;</b> [...]] <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Read command returns the features state (enabled/disabled).
<b>Test</b>	AT+MAFEAT=?	<b>+MAFEAT: (&lt;list of supported &lt;feature&gt;s), (&lt;list of supported &lt;state&gt;s)</b> <b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Test command returns the list of supported features' numbers and supported states (enable/disable).

The following table shows the +MAFEAT parameters.

**Table 3-203: MAFEAT Parameters**

<Parameter>	Description
<b>&lt;feature&gt;</b>	A number between 1 to 7 which is built from a combination of: 1 - Side tone 2 - Echo cancel 4 - Noise suppress
<b>&lt;state&gt;</b>	0 - Disable 1 - Enable

### Example

```

AT+MAFEAT=5,1           //Enables sidetone and noise suppress
OK
AT+MAFEAT?
+MAFEAT: 1,1           //Feature=1 (sidetone), state=1 (enabled)
+MAFEAT: 2,0           //Feature=2 (echo cancel), state=0 (disabled)
+MAFEAT: 4,1           //Feature=4 (noise suppress), state=1 (enabled)
OK

```

## General Audio Commands

### +MADIGITAL, Analog/Digital Audio Switching

This command switches between analog and digital audio modes. AT+MADIGITAL=1 switches to digital audio mode, and AT+MADIGITAL=0 switches it back to analog audio mode.

**Note:** After switching back to analog mode C24 will enter to Advanced audio mode.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MADIGITAL= <mode>	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	The Set command toggles between analog and digital audio modes.
<b>Read</b>	+MADIGITAL?	+MADIGITAL:<mode> <b>OK</b>	The Read command returns the current audio mode (analog or digital).
<b>Test</b>	+MADIGITAL=?	+MADIGITAL: <available audio modes> <b>OK</b>	The test command returns the available digital audio modes.

The following table shows the +MADIGITAL parameters.

**Table 3-204: +MADIGITAL Parameters**

<Parameter>	Description
<mode>	0 C24 works in analog audio mode. 1 C24 works in digital audio mode.

#### Example

```

AT+MADIGITAL=?
+MADIGITAL: (0,1)
OK
AT+MADIGITAL?
+MADIGITAL: 0
OK
AT+MADIGITAL=1
OK
AT+MADIGITAL?
+MADIGITAL: 1
OK
AT+MADIGITAL=0
OK
AT+MADIGITAL?
+MADIGITAL: 0
OK
AT+MADIGITAL=3
ERROR
AT+MADIGITAL?
+MADIGITAL: 0
OK

```

## +CALM, Sound Mode

This command handles the selection of the C24's sound mode. The value of the command is saved after a power cycle.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+CALM=<mode>	<b>OK</b> +CME ERROR: <err>	The Set command sets the sound mode.
<b>Read</b>	+CALM?	+CALM: <mode> +CME ERROR: <err>	The Read command displays the current sound mode setting.
<b>Test</b>	+CALM=?	+CALM: (list of supported <mode>s) +CME ERROR: <err>	The Test command displays the list of supported modes.

The following table shows the +CALM parameters.

**Table 3-205: +CALM Parameters**

<Parameter>	Description
<mode>	0     normal mode (default) 1     silent mode (all sounds from C24 are prevented)

**Note:** Selecting the alert mode with this command retrieves the current alert volume level setting.

### Example

```
AT+CALM=?
+CALM: (0,1)
OK
AT+CALM?
+CALM: 0
OK
AT+CALM=1
OK
```



## +MDMIC, Enable/Disable Microphone Level Setting in Digital Audio Mode

This command Enables/Disables the setting of the microphone level in digital audio mode via +MMICG command.

**Note:** Do not change +MDMIC settings during an active voice call.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MDMIC=<Mode>	OK Or: +CME ERROR: <err>	<Mode> is saved after power down.
<b>Read</b>	AT+MDMIC?	+MDMIC: <mode> OK	
<b>Test</b>	AT+MDMIC=?	+MDMIC: (list of supported <modes>) OK	

The following table shows the +MDMIC parameters.

**Table 3-206: +MDMIC Parameters**

<Parameter>	Description
<b>&lt;Mode&gt;</b>	<p>0 - Disables the control of microphone level setting in digital audio mode via +MMICG. i.e. microphone level setting will not be affected by +MMICG. This is the default value when +MDMIC set command is never used.</p> <p>1 - Enables the control of microphone level setting in digital audio mode via +MMICG. i.e. microphone level setting will be affected by +MMICG.</p>

## + MMICG, Microphone Gain Value

This command handles the selection of microphone gain values of MIC-handsets. The new value remains after power cycle. This command affects in digital audio mode, only when +MDMIC command is used to enable the microphone setting.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MMICG=<gain>	OK +CME ERROR: <err>	The Set command sets the microphone gain value.

Command Type	Syntax	Response/Action	Remarks
Read	+MMICG?	+MMICG: <gain> +CME ERROR: <err>	The Read command displays the current microphone gain.
Test	+MMICG=?	+MMICG (list of supported <gain>s) +CME ERROR: <err>	The Test command displays the list of supported gain values.

The following table shows the +MMICG parameters.

**Table 3-207: +MMICG Parameters**

<Parameter>	Description
<gain>	Microphone gain values in db: 0-31 0 is lowest gain value (not mute); default is 16 db

#### Example

```
AT+MMICG=?  
+MMICG: (0-31)  
OK  
AT+MMICG?  
+MMICG: 16  
OK  
AT+MMICG=30  
OK
```

## +CRTT, Ring Type Selection

This command plays one cycle of a ring tone, stops the cycle in the middle and sets the ring tone to be used per type of call.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+CRTT= <RingTypeNumber>, <operation> [, <Alert Field>]	<b>OK</b> or: +CME ERROR: <err>	The Set command sets the ring type, operation and Alert Field.
<b>Read</b>	AT+CRTT?	+CRTT: <AlertField>,<RingType eNumber> [<CR><LF>]+CRTT: <AlertField>,<RingType eNumber> [...] <b>OK</b> or: +CME ERROR: <err>	The Read command returns the Alert field and ring type number.
<b>Test</b>	AT+CRTT=?	+CRTT: (list of supported <RingTypeNumber>s), (list of supported <operation>s , <Alert Field> ) <b>OK</b> or: +CME ERROR: <err>	The Test command returns the list of supported tone type numbers, operations and Alert field.

### Notes:

1. If there is any Alert while ring tone is playing, the played ring tone will vanish & incoming Alert will play according to the set Ring tone type.
2. If stop is entered, any Ring Type Number (1-19) can be entered.

The following table shows the +CRTT parameters.

**Table 3-208: +CRTT Parameters**

<Parameter>	Description
<RingType Number>	Ring tone styles 1-19 (see Table 3-209)

**Table 3-208: +CRTT Parameters (Cont.)**

<Parameter>	Description
<operation>	Play or set a tone 0 Play (play one cycle) 1 Set 2 Stop
<Alert Field>	The sum of integers each is representing a class of information. 1 VOICE CALLS 2 DATA_CALLS 4 FAX_CALLS 8 INBOX 16 VOICE MAIL The default value is 7.

**Table 3-209: Ring Tone Types Available**

CRTT=X	Ring Tone Style Name
1	Alert
2	Alert2
3	Bells
4	Bits & Bytes
5	Charger1
6	Charger2
7	Door Bell
8	Triads
9	Wind Chimes
10	Up and Down

CRTT=X	Ring Tone Style Name
11	Random
12	Start Up
13	Cosmic
14	Cosmic2
15	Interlude
16	Power Surge
17	Clouds
18	Waves
19	Silent

**Example**

AT+CRTT=6,0,1 //Ring type number 6, operation 0 (play) , Alert Field 1 (voice calls)  
OK

AT+CRTT=14,2 //Ring type number 14, operation 2 (stop)  
OK

AT+CRTT=?  
+CRTT: (1-19),(0-2),(1-31)  
OK

AT+CRTT?  
+CRTT: 1,7 // Alert Field =1 (voice calls) , Ring type Number =7 (Door Bell)  
+CRTT: 2,15 // Alert Field =2 (data calls) , Ring type Number =15 (Interlude)  
+CRTT: 4,13 // Alert Field =4 (fax calls) , Ring type Number =13 (Cosmic)  
+CRTT: 8,12 // Alert Field =8 (inbox), Ring type Number =12 (Start Up)

**+CRTT: 16,16** // Alert Field =16 (voice mail), Ring type Number =16 (Power Surge)

**OK**

**AT+CRTT=6,1,7** //Ring type number 6,operation 1 (set) , Alert Field 1 (voice + data + fax calls)

**OK**

**AT+CRTT=7,1,24** //Ring type number 7,operation 1 (set) , Alert Field 1 (inbox + voice mail)

**OK**

**AT+CRTT=5,4,3** //value 4 out of bound

**+CME ERROR: numeric parameter out of bounds**

## +VTD, Tone Duration

This command handles the selection of tone duration. An integer <n> defines the length of tones emitted as a result of the +VTS command. This command does not affect the D (dial) command. (Refer to “[D, Dial Command](#)” on page 3-12.)

Any value other than zero causes a tone of duration <n> in multiples of 100 msec.

In this command, the new value is erased after power down.

**Note:** The tone duration value can be modified depending on the specific network.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>+VTD=&lt;n&gt;</b>	<b>OK.</b> <b>+CME ERROR: &lt;err&gt;</b>	The Set command sets the tone duration.
<b>Read</b>	<b>+VTD?</b>	<b>&lt;n&gt;</b> <b>+CME ERROR: &lt;err&gt;</b>	The Read command displays the current tone duration.
<b>Test</b>	<b>+VTD=?</b>	<b>+VTD: (list of supported &lt;n&gt;s)</b> <b>+CME ERROR: &lt;err&gt;</b>	The Test command displays the list of supported tone durations.

The following table shows the +VTD parameters.

**Table 3-210: +VTD Parameters**

<Parameter>	Description
<b>&lt;n&gt;</b>	Defines the length of tones emitted by the +VTS command. 0-600 Multiples of 100 msec (0 is equivalent to 1, that is, 100 msec) The default is 5 multiples of 100 msec.

**Example**

```
AT+VTD=?  
+VTD: (0-600)  
OK  
AT+VTD?  
+VTD: 5  
OK  
AT+VTD=10  
OK
```

**+VTS, Command-Specific Tone Duration**

This command transmits a string of DTMF tones when a voice call is active. DTMF tones may be used, for example, when announcing the start of a recording period.

The duration does not erase the VTD duration (Refer to [“+VTD, Tone Duration” on page 3-319](#)).

**Note:** The tone duration value can be modified depending on the specific network.

If the active call is dropped in the middle of playing a DTMF tone, the following unsolicited message transfers to TE: +VTS: "Call termination stopped DTMF tones transmission".

Command Type	Syntax	Response/Action	Remarks
Set	+VTS= <DTMF>,<duration>]	OK +CME ERROR: <err>	The Set command sets the tone and duration (if entered).
Read	+VTS?	+VTS: <DTMF> +CME ERROR: <err>	The Read command displays the currently transmitted DTMF tone. An error is displayed if no tone is active.
Test	+VTS=?	+VTS: (list of supported <DTMF>, (list of supported <duration>s) +CME ERROR: <err>	The Test command displays the list of supported DTMF tones and tone lengths.

The following table shows the +VTS parameters.

**Table 3-211: +VTS Parameters**

<Parameter>	Description
<DTMF>	String of ASCII characters (0-9, #, *) String length is up to 32 characters long.
<duration>	A DTMF tone of different duration from that set by the +VTD command. 0-600      Multiples of 100 msec (0 is equivalent to 1, that is, 100 msec) <duration> does not erase the +VTD duration.

**Note:** The duration defined by +VTS is specific to the DTMF string in this command only. It does not erase the duration defined by the +VTD command, and is erased when the C24 is powered down.

If <duration> is not defined, the +VTD value is used.

#### Example

```
AT+VTS?
+VTS: "5"
OK
AT+VTS="2",10
OK
```

#### +MAMOD, Select Audio Mode

This command selects the audio mode for ECHO cancellation.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	+MAMOD= <mode>	OK or: +CME ERROR: <err>	
<b>Read</b>	+MAMOD?	+MAMOD: <mode> OK	
<b>Test</b>	+MAMOD=?	+MAMOD: (list of supported modes) OK	

The following table shows the +MAMOD parameters.

**Table 3-212: +MAMOD Parameters**

<Parameter>	Description
<mode>	0 - Handset Mode (default) 1 - Headset Mode 2 - Car Kit Mode 3 - Speakerphone Mode

**Note:**

1. The +MAMOD setting takes effect only when ES is enabled by ATS96=1 or equivalent MAFEAT.
2. The mode is independent of the selected HW audio path (analog, digital, etc.).
3. Gain settings by MAVOL and MMICG should work normally in each mode.



## Firmware Update Over the Air (FOTA)

During firmware download, the module is in data session. Any AT command can be set during the download.

When downloading is finished and +MFOTAIND: 50,19 is received, no more AT commands can be set until upgrade process is fully finished and the unit is powered up with the new SW version in command mode.

When FUMO is in process it is impossible to establish voice/CSD/1x calls. If trying to do it, a "CME ERROR: operation not allowed" is returned.

It is possible to establish a call between the DM session and the download itself (between indications 5 and 14) but it is not recommended since it will cause the FUMO process to abort.

In case voice call is required, please abort the session by: +MFOTAABORT.

In case voice/data call is already active and the network starts a FUMO process (NIFUMO) - this transaction will not disconnect the call but re-start 1 minute after the call is hang-up.

It is recommended to use the FOTA indications (+MFOTAIND=1) so it will be clear what is the current state of the module.

If the module power off during download, the package will redownload again from the beginning after power on.

In case the power off was in the middle of installation stage, the installation will continue after the power on.

### +MFOTACNFG, Set the DM Session as Automatic/Non-Automatic

This command enables to set the DM session as Automatic/Non-Automatic (i.e. Transparent/Non-Transparent).

Default value is Automatic DM session.

Upon the receiving of the AT+MFOTACNFG command, the module will perform the following tasks:

1. Validate OMA-status is "idle" and DM-session is not active. If not, the module will abort the command with a CME error "operation not allowed" (code 3).
2. Otherwise - set the appropriate Flex params, return OK to DTE.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MFOTACNFG= <Automatic DM session>	<OK> or: +CME ERROR: <"operation not allowed">	Enable/Disable FOTA feature at the selected DM mode.

Command Type	Syntax	Response/Action	Remarks
Read	AT+MFOTACNFG?	+MFOTACNFG: <Automatic DM session>	Provide FOTA session state.
Test	AT+MFOTACNFG=?	+MFOTACNFG : list of <Automatic_DM_Mode> OK	

The following table shows the +MFOTACNFG parameters.

**Table 3-213: +MFOTACNFG Parameters**

<Parameter>	Description	Remarks
<Automatic DM session>	0 - Non automatic DM session 1 - Automatic DM session	"Automatic DM Session" enables the network to contact and establish a secure connection with the modem without direct user interaction.

#### Example

```

AT+MFOTACNFG?           // Get the FOTA DM session mode

+MFOTACNFG: 0
OK

AT+MFOTACNFG=1          // change the FOTA DM session mode to Automatic

OK

AT+MFOTACNFG?           // Get the FOTA DM session mode
+MFOTACNFG: 1

OK

AT+MFOTACNFG=?
+MFOTACNFG: (0-1)
OK

```

## +MFOTAREQ, Send FOTA Requests Toward DTE

When +MFOTAREQ operational reports are enabled during FOTA process (The reports might be enabled or disabled depends on +MFOTACNFG set command), the module will send confirmation requests toward DTE and the user has to respond using +MFOTARSP.

In case that the user missed the last request indication, he can use this command to show the last request, and respond accordingly. See "Execute" command Type on table below.

In MUX mode, this AT command is allowed on DLC2 only.

Command Type	Syntax	Response/Action	Remarks
Unsolicited Report	+MFOTAREQ: <FOTA-Operation>		
Execute	AT+MFOTAREQ	+MFOTAREQ: <FOTA-Operation>	

The following table shows the +MFOTAREQ parameters.

**Table 3-214: +MFOTAREQ Parameters**

<Parameter>	Description
<FOTA-Operation>	0 - No request is waiting for respond. 1 - Request to begin DM session. 2 - Allow download Update-Package? 3 - Upgrade Phone Software Now?

#### Example

```
+MFOTAREQ: 1           // Request to begin DM session
AT+MFOTARSP=0          // Confirm DM session beginning
OK
+MFOTAREQ: 2           // Request to start downloading an Update-Package
AT+MFOTARSP=0          // Confirm the download operation
OK
+MFOTAREQ: 3           // Request to Upgrade Phone Software
AT+MFOTAREQ
+MFOTAREQ: 3
AT+MFOTARSP=2          // Postpone the Upgrade operation
OK
```

### +MFOTARSP, Respond to +MFOTAREQ Report

This command is used to send a response to +MFOTAREQ reports.

Upon receiving the +MFOTAREQ DTE should Start/Reject/Postpone the request by sending response (+MFOTARSP) to Module.

In case Module receives "Start" operation:

If Module is in "Idle" State -> it will perform the requested operation. Otherwise -> it will

respond with CME error "Operation not allowed".

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+ MFOTARSP =</b> <b>&lt;action&gt;</b>	<b>&lt;OK&gt;</b> <b>or:</b> <b>+CME ERROR:</b>	
<b>Test</b>	<b>AT+ MFOTARSP=?</b>	<b>+ MFOTARSP: (list of supported&lt;action&gt;s)</b>	

The following table shows the +MFOTARSP parameters.

**Table 3-215: +MFOTARSP Parameters**

<Parameter>	Description	Remarks
<b>&lt;action&gt;</b>	0 - start 1 - reject 2- one hour postpone	2 - relevant for upgrade operation only.

#### Example

```

+MFOTAREQ: 1                // Request to begin DM session

AT+MFOTARSP=0                // Confirm DM session beginning
OK

+MFOTAREQ: 2                // Request to start downloading an Update-Package

AT+MFOTARSP=1                // Reject the download operation
OK

+MFOTAREQ: 3                // Request to Upgrade Phone Software
AT+MFOTARSP=2                // Postpone the Upgrade operation
OK

```

## +MFOTAINSTL, Install the FOTA Updated Package

Install the updated package if the conditions are met:

If update package was downloaded and OMA state is "Ready to update" then the module will start updates installation, otherwise, the module will reply with CME error: "operation not allowed".

Command Type	Syntax	Response/Action	Remarks
Execute	AT+MFOTAINSTL	OK or: +CME ERROR<err>	Install the updated package.

## +MFOTAABORT, Abort the DM Session

This command enables to abort the DM session. As a result, the FOTA activities above DM session (interaction with the server and download) are stopped.

Command Type	Syntax	Response/Action	Remarks
Execute	+MFOTAABORT	OK or: +CME ERROR<err>	The Execute command aborts the DM session. OK is returned.

### Example

```
+MFOTAREQ: 2           // Download request
AT+MFOTARSP=0          // Confirm the download operation
OK
+MFOTAIND: 10, 4
+MFOTAIND: 10, 5        // DM Session in progress
+MFOTAIND: 10, 7        // DM Session complete
+MFOTAIND: 16, 14       // Download in progress
+MFOTAIND: 16, 13, 0    // Progress bar indication
+MFOTAIND: 16, 13, 5    // Progress bar indication
AT +MFOTAABORT          // Abort download
OK
```

## +MFOTAIND, Send Unsolicited FOTA Indications Toward the DTE

When set, the module will send all the indications mentioned in [Table 3-216](#).

By default, FOTA unsolicited information report is Disabled.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+MFOTAIND=</b> <b>&lt;EN-ind&gt;</b>	<b>OK</b> <b>or:</b> <b>+CME ERROR:&lt;err&gt;</b>	The Set command enables/disables Unsolicited indications. See <a href="#">Table 3-216</a> .
<b>Read</b>	<b>AT+MFOTAIND?</b>	<b>+ MFOTAIND:</b> <b>&lt; EN-ind &gt;,</b> <b>OK</b>	Returns <EN-ind> value.
<b>Test</b>	<b>AT+FOTAIND=?</b>	<b>+ MFOTAIND: (list of supported&lt;EN-ind&gt;s)</b>	
<b>Unsolicited Report</b>	<b>+FOTAIND</b>	<b>+FOTAIND: &lt;OMA state&gt;, &lt;FOTA-Indication&gt;</b>	OMA state and FOTA information reports during FOTA process.

The following table shows the +MFOTIND parameters.

**Table 3-216: +MFOTAIND Parameters**

<Parameter>	Description
<b>&lt;EN-ind&gt;</b>	0 - Disable FOTA unsolicited informational report. 1 - Enable FOTA unsolicited informational report. The default value is 0. Enables the Module to indicate the DTE with FOTA progress.

**Table 3-216: +MFOTAIND Parameters (Cont.)**

<Parameter>	Description
<OMA state>	10 Idle/Start - No pending operation. 20 Download Failed. 30 - Download progressing + % completed 40 Download complete - Successfully. 50 - Ready to update - awaiting command to make update 60 Update progressing - update has started. 70 Update failed. User Cancelled. 80 Update failed. 90 Update Successful.
<FOTA-indications>	4 Warning: Open applications may be closed. 5 DM Session in progress. 6 End call question. 7 DM Session completed. 8 DM session interrupted. 9 Unable to connect to server. 10 Bootstrap completed. 11 Access failed. 12 Download failed. 13,xx Software update xx% completed. 14 Download in progress. 15 Reminder in: 1 hour select AT+MFOTAINSTL to update SW. 16 SW update complete. 17 Update not applied. The phone will recover the original configuration. 18 No update package available. 19 Update has started.

**Example**

```

AT+MFOTAIND?
+MFOTAIND: 0
OK
AT+MFOTAIND=?
+MFOTAIND: (0,1)
AT+MFOTAIND=1           // Enable FOTA unsolicited informational report
OK

```

**+MFOTARLBCK, Install Reverse Firmware Version**

This command causes the module to install the reverse firmware version.

Command Type	Syntax	Response/Action	Remarks
Execute	AT+ MFOTARLBCK	OK or: +CME ERROR	

## +MFOTASTART

This command enable the DTE originates DM session and FOTA download & install.

Command Type	Syntax	Response/Action	Remarks
Execute	AT+MFOTASTART	OK or: +CME ERROR	

### Example

```
AT+MFOTASTART
OK
```

## OMA-DM

Sprint provides customer functionality and miscellaneous services that will utilize "server-initiated" OMA DM sessions. These services include, but are not limited to, firmware updates, PRL updates, and application downloads, etc.

The OMA-DM sessions can be initiated by the network (NI) or by the Client (CI).

### Notes:

- In Sprint req. OMA-DM run in profile 0, and other data session run in profile 1. Other data session is restricted when OMA is in progress as DUN, TCPIP etc.
- HFA (Hands-Free Activation) – is basically a CIDC session that is automatically triggered by the device. A Hands-Free Activation session is only triggered for initial activation on the first power-up, or on the first power-up after being refurbished (Master Reset: +MMR).
- HFA retries - If the device connects to the OMA-DM server and no profile information is available, the device will pause for 60 seconds and retry up to 5 times. The device will retry only when successfully connecting to the server and no profile information is available. The device will not retry when an error occurs during the connection or the session with the server.
- NIDC/NIPRL/NIFUMO – Only in case of network initiate if the session establishment fails due to network problem, the OMA-DM Client will attempt to re-establish the session every 1 minute until the DM session is successful or until it retries 5 times.



## +MODDC - OMA-DM Device Configuration

This command Enable/Disable the OMA-DM DC update.

Upon the receiving of the AT+MODDC command, the module will perform the following tasks:

1. Validate OMA-status is "idle" and DM-session is not active. If not, the module will abort the command with a CME error "operation not allowed" (code 3).
2. Otherwise - set the appropriate Flex params, return OK to DTE.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MODDC=<mode>	OK  or  ERROR: <error_code>	
Read	AT+ MODDC?	+ MODDC: < mode > OK  or  ERROR: <error_code>	
Test	AT+ MODDC=?	+ MODDC: <list of supported modes > OK  or  ERROR: <error_code>	

The following table shows the +MODDC parameters.

**Table 3-217: +MODDC Parameters**

<Parameter>	Description
<mode>	0 - Disable NIDC/CIDC 1 - Enable NIDC/CIDC (default)

## +MODPRL - OMA-DM PRL

This command Enable/Disable the OMA-DM PRL update.

Upon the receiving of the AT+MODPRL command, the module will perform the following tasks:

1. Validate OMA-status is "idle" and DM-session is not active. If not, the module will abort the command with a CME error "operation not allowed" (code 3).

2. Otherwise - set the appropriate Flex params, return OK to DTE.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MODPRL=<mode>	OK  or  ERROR: <error_code>	
Read	AT+ MODPRL?	+ MODPRL: < mode > OK  or  ERROR: <error_code>	
Test	AT+ MODPRL=?	+ MODPRL: <list of supported modes > OK  or  ERROR: <error_code>	

The following table shows the +MODPRL parameters.

**Table 3-218: +MODPRL Parameters**

<Parameter>	Description
<mode>	0 - Disable NIPRL/CIPRL 1 - Enable NIPRL/CIPRL (default)

## +MODFUMO - OMA-DM FUMO

This command Enable/Disable the OMA-DM FUMO update.

Upon the receiving of the AT+MODFUMO command, the module will perform the following tasks:

1. Validate OMA-status is "idle" and DM-session is not active. If not, the module will abort the command with a CME error "operation not allowed" (code 3).

2. Otherwise - set the appropriate Flex params, return OK to DTE.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+MODFUMO=&lt;mode&gt;</b>	<b>OK</b>  <b>or</b> <b>ERROR: &lt;error_code&gt;</b>	
<b>Read</b>	<b>AT+ MODFUMO?</b>	<b>+ MODFUMO: &lt; mode &gt;</b> <b>OK</b>  <b>or</b> <b>ERROR: &lt;error_code&gt;</b>	
<b>Test</b>	<b>AT+ MODFUMO=?</b>	<b>+ MODFUMO: &lt;list of supported modes &gt;</b> <b>OK</b>  <b>or</b> <b>ERROR: &lt;error_code&gt;</b>	

The following table shows the +MODFUMO parameters.

**Table 3-219: +MODFUMO Parameters**

<Parameter>	Description
<b>&lt;mode&gt;</b>	0 - Disable NIFUMO/CIFUMO 1 - Enable NIFUMO/CIFUMO (default)

## +MODCI - OMA-DM Client Initiating

This command supports the client initiating of OMA-DM session.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MODCI=<action>	OK or ERROR: <error_code>	
Read	AT+ MODCI?	+ MODCI: < action > OK or ERROR: <error_code>	
Test	AT+ MODCI=?	+ MODCI: <list of supported actions > OK or ERROR: <error_code>	

The following table shows the +MODCI parameters.

**Table 3-220: +MODCI Parameters**

<Parameter>	Description
<action>	0 - initiate CIDC (Update of Device Configuration) 1 - initiate CIPRL (Update of PRL) 2 - abort the session

## +MODNI - OMA-DM Network Initiating

This command supports the NW initiating of OMA-DM session.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MODNI=<action>	OK  or  ERROR: <error_code>	
Test	AT+ MODNI=?	+ MODNI: <list of supported actions > OK  or  ERROR: <error_code>	

The following table shows the +MODNI parameters.

**Table 3-221: +MODNI Parameters**

<Parameter>	Description
<action>	0 - abort the session

## +MODIND - OMA-DM Indications

This command displays the progress of the updates.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MODIND=<ind>	OK  or  ERROR: <error_code>	
Read	AT+MODIND?	+MODIND: < ind >  OK	

Command Type	Syntax	Response/Action	Remarks
Test	AT+MODIND=?	+MODIND: (list of supported<ind>s)  OK	
Unsolicited Report	+MODIND: <OMA-DM-Indication>		

The following table shows the +MODIND parameters.

**Table 3-222: +MODIND Parameters**

<Parameter>	Description
<ind>	0 - Disable OMA-DM unsolicited informational report. 1 - Enable OMA-DM unsolicited informational report. The default value is 0.
<OMA-DM-Indication>	1 - "Network Initiated, INFORMATIVE " 2 - "CIDC Started" 3 - "Network Initiated, BACKGROUND" 4 - "CIPRL Started" 5 - "HFA Started " 6 - "Checking for DC Update" 7 - "Updating DC" 8 - "No provisioning update available" 9 - "Checking for PRL Update" 10 - "Updating PRL" 11 - "No PRL update available" 12 - "DC Update Complete" 13 - "PRL Update Complete" 14 - "HFA Update Complete" 15 - "Update Failed Error xxx" 16 - "Retry Re-Establish Session" 17 - "Session Aborted" 18 - "Network Initiated, Complete"

**Note:** The indication report value can't be changed during updates

#### Example

```

AT+MODIND?
+MODIND: 0
OK
AT+MODIND=?
+MODIND: (0,1)
AT+MODIND=1           // Enable OMA-DM unsolicited informational report
OK

```

## OTASP

### +MOTAIND - OTASP Indication

This command displays the progress of updates. It is defined for Verizon operator.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MOTAIND=<ind>	OK  or  ERROR: <error_code>	
Read	AT+MOTAIND?	+MOTAIND: <ind>  OK	
Test	AT+MOTAIND=?	+MOTAIND: (list of supported<ind>s)  OK	
Unsolicited Report	+MOTAIND: <OTASP-Indication>		

The following table shows the +MOTAIND parameters.

**Table 3-223: +MOTAIND Parameters**

<Parameter>	Description
<ind>	0 - Disable OTASP unsolicited informational report. 1 - Enable OTASP unsolicited informational report. The default value is 0. The value is saved after power down.
<OTASP-Indication>	1 - "Initial programming required" 2 - "Programming in progress" 3 - "NAM download OK" 4 - "PRL download OK" 5 - "Commit Successful" 6 - "Programming Successful" 7 - "Programming Unsuccessful"

#### Example

```
AT+MOTAIND?
+ MOTAIND: 0
OK
AT+MOTAIND=?
```

+ MOTAIND: (0,1)

AT+MOTAIND=1 // Enable OTASP unsolicited informational report

OK





## GPS - LBS

### Motorola Binary AT Commands

#### +MGPSMODE, Select Operation Mode

This command supports the GPS operation mode.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSMODE =<mode>	OK  or  ERROR: <error_code>	
Read	AT+MGPSMODE?	+ MGPSMODE: <mode> OK	
Test	AT+MGPSMODE=?	+ MGPSMODE: (list of supported<mode>s)	

The following table shows the +MGPSMODE parameters.

**Table 3-224: +MGPSMODE Parameters**

<Parameter>	Description
<mode>	1 - Autonomous/Standalone (default, will be check with operators) 2 - MS Based 3 - MS-Assisted/Hybrid.

## +MGPSLOC, Location Message

This command displays solicited/unsolicited location message to the terminal.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MGPSLOC=<mode>[,<FixInterval>]	OK  or  ERROR: <error_code>	
<b>Execute</b>	AT+MGPSLOC	+MGPSLOC: <Date>,<Time>,<Position>,<Velocity>,<Heading>,<SatelliteInfo>,<ReceiverStatus> OK  or:  +CME ERROR: <err>	
<b>Read</b>	AT+ MGPSLOC?	+MGPSLOC: <mode>,<FixInterval> OK	
<b>Test</b>	AT+ MGPSLOC=?	+MGPSLOC: (list of supported<mode>s), (list of supported< FixInterval>s)	

The following table shows the +MGPSLOC parameters.

**Table 3-225: +MGPSLOC Parameters**

<Parameter>	Description
<mode>	0 - Disable MGPSLOC unsolicited indication. 1 - Enable MGPSLOC unsolicited indication. The default value is 0.
<FixInterval>	0 - One Time Fix (Polled) (default). 1- 3600 - Fix Interval in Sec.
<Date>	Month: 1..12 Day: 1..31 Year: yyyy
<Time>	Hours: 0..23 Minutes: 0..59 Seconds: 0..59 fractional second: 0..999 ms
<Position>	Latitude: -324,000,000..324,000,000 (-90?.. 90?) Longitude: -648,000,000..648,000,000 (-180?.. 180?) Ellipsoid height in cm: -100,000..1,800,000
<Velocity>	Velocity in cm/s 0..51,400
<Heading>	0..3599
<SatelliteInfo>	Number of Visible Satellites 0..12 Number of Satellites Tracked 0..8
<ReceiverStatus>	bit0 - DOP - poor quality (DOP>8) bit1 - 3D bit2 - 2D bit3 - Acquiring Satellites bit4 - Searching (< 3Sat) bit5 - Last fix bit6 - Bad almanac bit7 - Reserved

**Note:** The effective minimum report interval is the actual fix time in each GPS mode.

In case the report interval is less than the fix location calculation time the module will not discard the previous calculation and the report to the terminal will be when the calculation complete. The C24 will start a new fix session when the previous calculation was finished.

### +MGPSLUPD, Location Update Data

This command set the interval of almanac/ephemeris data downloads.

The Almanac contains information about all the satellites in the constellation

The Ephemeris contains short-lived information about the constellation and the particular satellite sending it.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+MGPSLUPD</b> <b>=&lt;interval&gt;</b>	OK  or  ERROR: <error_code>	
<b>Read</b>	<b>AT+ MGPSLUPD?</b>	+ MGPSLUPD: <interval> OK	
<b>Test</b>	<b>AT+ MGPSLUPD=?</b>	+ MGPSLUPD: (list of supported<interval>s)	

The following table shows the +MGPSLUPD parameters.

**Table 3-226: +MGPSLUPD Parameters**

<Parameter>	Description
<interval>	0 - One time download (default). 1-255 - interval between downloads in minutes.

### **+MGPSPPDEIP, IP Configuration for Primary PDE**

This command set the IP address and port for the primary PDE server.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+MGPSPPDEIP</b> <b>=&lt;ip&gt;,&lt;port&gt;</b>	OK  or  ERROR: <error_code>	
<b>Read</b>	<b>AT+MGPSPPDEIP?</b>	+MGPSPPDEIP: <ip>,<port> OK	
<b>Test</b>	<b>AT+MGPSPPDEIP=?</b>	+MGPSPPDEIP: (<IP>),(list of supported<port>)	

The following table shows the +MGPSPPDEIP parameters.

**Table 3-227: +MGPSPPDEIP Parameters**

<Parameter>	Description
<ip>	xxx.xxx.xxx.xxx (0<=xxx<=255)
<port>	0-65535

### +MGSSPDEIP, IP Configuration for Secondary PDE

This command set the IP address and port for the secondary PDE server.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MGSSPDEIP =<ip>,<port>	OK  or  ERROR: <error_code>	
<b>Read</b>	AT+MGSSPDEIP?	+MGSSPDEIP: <ip>,<port> OK	
<b>Test</b>	AT+MGSSPDEIP=?	+MGSSPDEIP: (<IP>),(list of supported<port>)	

The following table shows the +MGSSPDEIP parameters.

**Table 3-228: +MGSSPDEIP Parameters**

<Parameter>	Description
<ip>	xxx.xxx.xxx.xxx (0<=xxx<=255)
<port>	0-65535

## +MGPSMPCIP, IP Configuration for MPC

This command set the IP address and port for the MPC server.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSMPCIP =<ip>,<port>	OK  or  ERROR: <error_code>	
Read	AT+MGPSMPCIP?	+MGPSMPCIP: <ip>,<port> OK	
Test	AT+MGPSMPCIP=?	+MGPSMPCIP: (<IP>),(list of supported<port>)	

The following table shows the +MGPSMPCIP parameters.

**Table 3-229: +MGPSMPCIP Parameters**

<Parameter>	Description
<ip>	xxx.xxx.xxx.xxx (0<=xxx<=255)
<port>	0-65535

## +MGPSPROT, Set GPS Protocol

This command sets the GPS protocol.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSPROT=<protocol>,<mode>	OK  or  ERROR: <error_code>	
Read	AT+MGPSPROT?	+MGPSPROT: <protocol>,<mode> OK	
Test	AT+MGPSPROT=?	+MGPSPROT: (list of supported< privacy level>s), (list of supported<mode>s)	

The following table shows the +MGPSPROT parameters.

**Table 3-230: +MGPSPROT Parameters**

<Parameter>	Description
<protocol>	0- Binary (default) 1- NMEA
<mode>	0- Disable (default) 1- Enable

### +MGPSRES, Reset of Location Parameters

This command resets all location related parameters.

The following information will be erased or changed to value 0 when this command is executed:

- GPS Almanac Data
- GPS Ephemeris Data
- PDE IP address
- PDE Port address
- Previous precision location solution which may be stored in the Module

Command Type	Syntax	Response/Action	Remarks
Execute	AT+MGPSRES	OK  or  ERROR: <error_code>	

### +MGPSQOS, Set QoS parameters

This command sets the GPS QoS parameters.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MGPSQOS=<thresh old>,< performance>	OK  or  ERROR: <error_code>	

Command Type	Syntax	Response/Action	Remarks
Read	AT+MGPSQOS?	+MGPSQOS: <threshold>,< performance> OK	
Test	AT+MGPSQOS=?	+MGPSQOS: (list of supported< threshold>s), (list of supported< performance>s)	

The following table shows the +MGPSQOS parameters.

**Table 3-231: +MGPSQOS Parameters**

<Parameter>	Description
<threshold>	0 - 1000 meters 1 - 500 meters 2 - 250 meters 3 - 100 meters 4 - 50 meters 5 - 25 meters
<performance>	0-255 secs

## +MNMEA, Motorola NMEA Routing

This commands routes the NMEA reports to UART2 or USB.

Command Type	Syntax	Response/Action	Remarks
Set	AT+MNMEA=<port>	OK  or  ERROR: <error_code>	
Read	AT+MNMEA?	+MNMEA: <port> OK	
Test	AT+MNMEA=?	+MGPSQOS: (list of supported< port>s)	



The following table shows the +MNMEA parameters.

**Table 3-232: +MNMEA Parameters**

<Parameter>	Description
<port>	0 - UART2 (default) 1 - USB

**Note:** In case of RUIM model NMEA output is via USB only. +MNMEA command is invalid.

## Motorola NMEA AT Commands

The following NMEA Output messages formats are supported.

### GGA -Global Positioning System Fixed Data

Name	Units	Description
Message ID		GGA protocol header
UTC Time		hhmmss.sss
Latitude		ddmm.mmmm
N/S Indicator		N=north or S=south
Longitude		dddmm.mmmm
E/W Indicator		E=east or W=west
Position Fix Indicator		See Table below
Satellites Used		Range 0 to 12
HDOP		Horizontal Dilution of Precision
MSL Altitude	meters	
Units	meters	
Geoid Separation	meters	
Units	meters	
Age of Diff. Corr.	second	Null fields when DGPS is not used
Diff. Ref. Station ID		
Checksum		
<CR> <LF>		End of message termination

The following table shows the GGA parameters.

**Table 3-233: GGA Parameters**

<Parameter>	Description
<Position Fix Indicator>	0 Fix not available or invalid 1 GPS SPS Mode, fix valid 2 Differential GPS, SPS Mode, fix valid

### Output Example

\$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M,, , ,0000\*18

Name	Example
Message ID	\$GPGGA
UTC Time	161229.487
Latitude	3723.2475
N/S Indicator	N
Longitude	12158.3416
E/W Indicator	W
Position Fix Indicator	1
Satellites Used	07
HDOP	1.0
MSL Altitude	9.0
Units	M
Geoid Separation	
Units	M
Age of Diff. Corr.	
Diff. Ref. Station ID	0000
Checksum	*18
<CR> <LF>	End of message termination

## GLL-Geographic Position - Latitude/Longitude

Name	Description
<b>Message ID</b>	GLL protocol header
<b>Latitude</b>	ddmm.mmmm
<b>N/S Indicator</b>	N=north or S=south
<b>Longitude</b>	dddmm.mmmm
<b>E/W Indicator</b>	E=east or W=west
<b>UTC Time</b>	hhmmss.sss
<b>Status</b>	A=data valid or V=data not valid
<b>Mode</b>	A=Autonomous, D=DGPS, E=DR (Only present in NMEA version 3.00)
<b>Checksum</b>	GLL protocol header
<b>&lt;CR&gt; &lt;LF&gt;</b>	ddmm.mmmm

### Output Example

```
$GPGLL,3723.2475,N,12158.3416,W,161229.487,A,A*41
```

Name	Example
<b>Message ID</b>	\$GPGLL
<b>Latitude</b>	3723.2475
<b>N/S Indicator</b>	N
<b>Longitude</b>	12158.3416
<b>E/W Indicator</b>	W
<b>UTC Time</b>	161229.487
<b>Status</b>	A
<b>Mode</b>	A
<b>Checksum</b>	*41
<b>&lt;CR&gt; &lt;LF&gt;</b>	End of message termination

## GSA-GNSS DOP and Active Satellites

Name	Description
<b>Message ID</b>	GSA protocol header
<b>Mode 1</b>	See Table 1
<b>Mode 2</b>	See Table 2
<b>Satellite Used</b>	Sv on Channel 1
<b>Satellite Used</b>	Sv on Channel 2
....	....
<b>Satellite Used1</b>	
<b>PDOP</b>	Position Dilution of Precision
<b>HDOP</b>	Horizontal Dilution of Precision
<b>VDOP</b>	Vertical Dilution of Precision
<b>Checksum</b>	
<b>&lt;CR&gt; &lt;LF&gt;</b>	End of message termination

The following table shows the GSA parameters.

**Table 3-234: GSA Parameters**

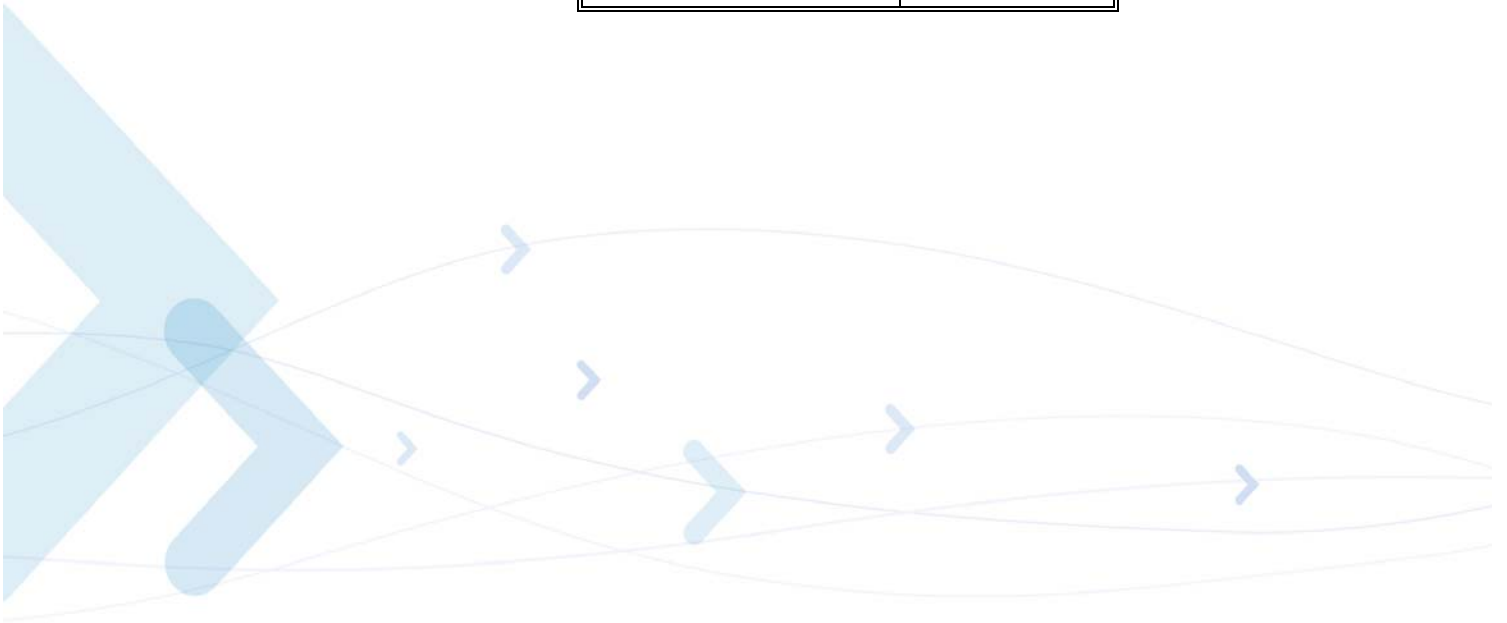
<Parameter>	Description
<b>&lt;Modem 1&gt;</b>	M - Manual-forced to operate in 2D or 3D mode. A - 2D Automatic-allowed to automatically switch 2D/3D.
<b>&lt;Modem 2&gt;</b>	1 - Fix not available 2 - 2D (<4 SVs used) 3 - 3D (>3 SVs used)

### Output Example

```
$GPGSA,A,3,07,02,26,27,09,04,15,,,,,1.8,1.0,1.5*33
```

Name	Example
<b>Message ID</b>	\$GPGSA
<b>Mode 1</b>	A
<b>Mode 2</b>	3
<b>Satellite Used</b>	07

Name	Example
Satellite Used	02
....	
Satellite Used1	Sv on Channel 12
PDOP	1.8
HDOP	1.0
VDOP	1.5
Checksum	*33
<CR> <LF>	



## GSV-GNSS Satellites in View

Name	Units	Description
Message ID		GSV protocol header
Number of Messages (*)		Range 1 to 3
Message Number		Range 1 to 3
Satellites in View		
Satellite ID		Channel 1 (Range 1 to 32)
Elevation	degrees	Channel 1 (Maximum 90)
Azimuth	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	dBHz	Range 0 to 99, null when not tracking
....		....
Satellite ID		Channel 4 (Range 1 to 32)
Elevation	degrees	Channel 4 (Maximum 90)
Azimuth	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	dBHz	Range 0 to 99, null when not tracking
Checksum		
<CR> <LF>		End of message termination

(\*) Depending on the number of satellites tracked, multiple messages of GSV data may be required.

### Output Example

```
$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71
```

Name	Example
Message ID	\$GPGSV
Number of Messages (*)	2
Message Number	1
Satellites in View	07
Satellite ID	07
Elevation	79
Azimuth	048
SNR (C/No)	42
....	

Name	Example
Satellite ID	27
Elevation	27
Azimuth	138
SNR (C/No)	42
Checksum	*71
<CR> <LF>	

### RMC-Recommended Minimum Specific GNSS Data

Name	Units	Description
Message ID		RMC protocol header
UTC Time		hhmmss.sss
Status1. A valid status is derived from the SiRF Binary M.I.D 2 position mode 1. See the SiRF Binary Protocol Reference Manual.1		A=data valid or V=data not valid
Latitude		ddmm.mmmm
N/S Indicator		N=north or S=south
Longitude		dddmm.mmmm
E/W Indicator		E=east or W=west
Speed Over Ground	knots	
Course Over Ground	degrees	True
Date		ddmmyy
Magnetic Variation	degrees	E=east or W=west
Mode		A=Autonomous, D=DGPS, E=DR
Checksum		
<CR> <LF>		End of message termination

## Output Example

```
$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598,*,*10
```

Name	Example
Message ID	\$GPRMC
UTC Time	161229.487
Status1. A valid status is derived from the SiRF Binary M.I.D 2 position mode 1. See the SiRF Binary Protocol Reference Manual.1	A
Latitude	3723.2475
N/S Indicator	N
Longitude	12158.3416
E/W Indicator	W
Speed Over Ground	0.13
Course Over Ground	309.62
Date	120598
Magnetic Variation	
Mode	A
Checksum	*10
<CR> <LF>	

## VTG-Course Over Ground and Ground Speed

Name	Units	Description
ID		VTG protocol header
Course	degrees	Measured heading
Reference	True	
Course	degrees	Measured heading
Reference		Magnetic
Speed	knots	Measured horizontal speed
Units		Knots
Speed	km/hr	Measured horizontal speed



Name	Units	Description
<b>Units</b>		Kilometers per hour
<b>Mode</b>		A=Autonomous, D=DGPS, E=DR
<b>Checksum</b>		
<b>&lt;CR&gt; &lt;LF&gt;</b>		End of message termination

### Output Example

\$GPVTG,309.62,T, ,M,0.13,N,0.2,K,A\*23

Name	Example
<b>ID</b>	VTG protocol header
<b>Course</b>	Measured heading
<b>Reference</b>	
<b>Course</b>	Measured heading
<b>Reference</b>	Magnetic
<b>Speed</b>	Measured horizontal speed
<b>Units</b>	Knots
<b>Speed</b>	Measured horizontal speed
<b>Units</b>	Kilometers per hour
<b>Mode</b>	A=Autonomous, D=DGPS, E=DR
<b>Checksum</b>	
<b>&lt;CR&gt; &lt;LF&gt;</b>	End of message termination

### ZDA-Time and Date

Name	Units	Description
<b>Message ID</b>		ZDA protocol header
<b>UTC time</b>		Either using valid IONO/UTC or estimated from default leap seconds
<b>Day</b>		01 to 31
<b>Month</b>		01 to 12
<b>Year</b>		1980 to 2079
<b>Local zone hour</b>	<b>knots</b>	Offset from UTC (set to 00)

Name	Units	Description
Local zone minutes		Offset from UTC (set to 00)
Checksum		
<CR> <LF>		End of message termination

### Output Example

\$GPZDA,181813,14,10,2003,00,00\*4F

Name	Example
Message ID	\$GPZDA
UTC time	181813
Day	14
Month	10
Year	2003
Local zone hour	00
Local zone minutes	00
Checksum	
<CR> <LF>	

### \$PMOTG, Execute NMEA Input Message Commands

The following NMEA Input messages format is supported.

Command Type	Syntax	Response/Action	Remarks
Execute	\$PMOTG, interval, yyyy <CR><LF>	OK  or  ERROR: <error_code>	
Execute	\$PMOTG, XXX, zzzCC< CR><LF>	OK  or  ERROR: <error_code>	

The following table shows the \$PMOTG parameters.

**Table 3-235: \$PMOTG Parameters**

<Parameter>	Description
<b>Message ID (\$PMOTG)</b>	Protocol Header.
<b>Identifier (XXXX)</b>	Output message command.
<b>Update rate (yyyy)</b>	0..9999 seconds
<b>Flag (true/false) (zzz)</b>	1/0
<b>Checksum (CC)</b>	
<b>&lt;CR&gt; &lt;LF&gt;</b>	End of message termination.

### Execution Example

```
$PMOTG,interval,20  
$PMOTG,GGA,zzzCC<CR><LF>  
$PMOTG,GSA,zzzCC<CR><LF>
```

**Note:** This command is not parsed by AT command protocol, only by C24 own protocol.

## Serial Configuration

The C24 module is capable of providing up to two universal asynchronous receiver transmitters (UART) ports. Each UART communicates with serial data ports that conform to the RS-232 interface protocol.

The C24 module supports a universal serial bus (USB). This bus may operate at USB low-speed (1.5 Mbits/sec) and USB full-speed (12 Mbits/sec). It is compliant with USB 2.0 Specification.

The C24 module supports SUSPEND/RESUME mechanism of USB, then the Sleep Mode is available for the USB connection. For more information about Sleep mode functionality, refer to [“Sleep Mode Commands” on page 3-223](#).

The following serial devices may enumerate over USB:

- Modem services;
- Diagnostic (QXDM/QPST) services;

The following table provides the possible C24 modes for serial configuration.

**Table 3-236: Possible Modes For Serial Configuration**

Mode	UART1	UART2	USB
#1	Modem	R-UIM/NMEA	Diagnostic services
#2		R-UIM/NMEA	Modem/Diagnostic services
#3	Diagnostic services	R-UIM/NMEA	Modem

- Mode 1 and mode 2 are automatically detected runtime (USB enumeration or UART1 HW lines connection/AT Command).
- GPS Binary may run only on the "Modem" port.
- GPS Binary and NMEA are mutual exclusive (Just one of them can be enabled).
- R-UIM and NMEA are mutual exclusive (Just one of them can be enabled).
- For setting of Baud Rate on UART2 refer to +IPR command description.
- MUX feature may be enabled by +MMUX command on UART1 or USB.
- Diagnostic tools use AT\$QCDMG command to enable a diagnostic services (QXDM/QPST) on the current port.

## MUX Feature

### Overview

The C24 is supplied with an internal 27.010 protocol stack, also referred to as a multiplexer or MUX.

The C24 with multiplexer support utility provides the following capabilities:

- Provides the terminal with up to five virtual channels on one physical RS-232 connection.
- Provides simultaneous data (CS/HSPD) and command (AT command set) services.

In this way, many applications can use a single RS232/USB line via virtual channels. This enables a user to make network and phone service inquiries and maintain data communication at the same time.

### Features and Benefits

The C24 with the MUX feature ENABLES multiple channel operation and simultaneous data and control operation. For example, it allows a user to be connected to an Internet website (DATA session connected), receive a file via CSD Call, and query the C24 phone book all at the same time.

The following actions are enabled during a data session:

- Incoming call alert string RING (while C24 is in DATA session)
- Answering to incoming call via the ATA command (while C24 is in DATA session) C24 MUX Integration
- Receive Incoming SMS indication
- Inquiry NW coverage indication
- Setup a voice call (while C24 is in DATA session)
- Send & Receive SMS
- Read/write to/from Phone Book
- Local modem operation
- Network interrogation and settings

### System Overview

The MUX service in the C24 provides multiple virtual channels for the DTE that can communicate simultaneously with the C24. This service allows the DTE to have channels for command and network indications while other channels are used for data sessions. This service is available when MUX software entities exist on both the DTE and the C24. These MUX entities

communicate with each other and provide data connection management, which includes establishment, control, release and data transfer between matching channels in the DTE and C24.

**Note:** MUX over RS232/USB is a software module. No PCB hardware changes are required at either the C24 or DTE side.

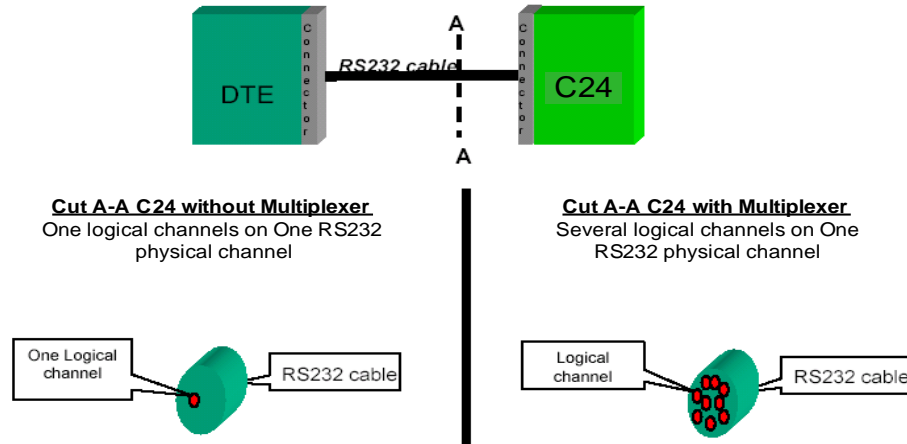


Figure 3-15: C24 with and without MUX

## Product Architecture

The following figure shows the former architecture (PREMUX).

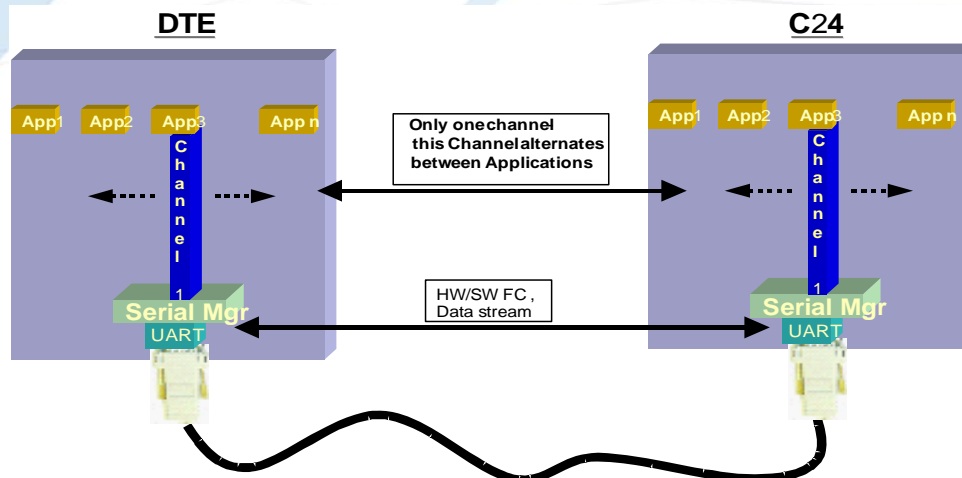


Figure 3-16: Former Architecture (PREMUX)

The following figure shows the current product architecture (MUX).

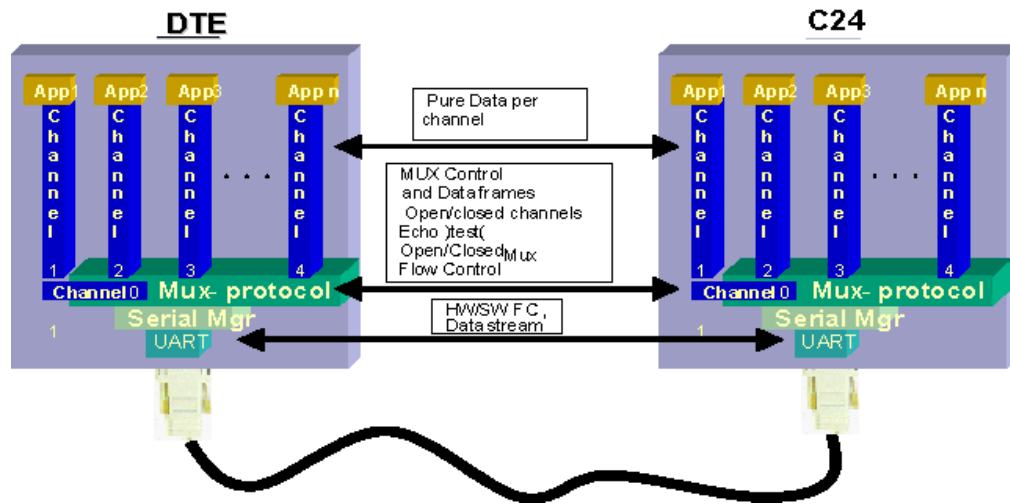


Figure 3-17: Product Architecture (MUX)

## MUX States Overview

The C24 MUX module has three states, PREMUX, MUX-Init and MUX.

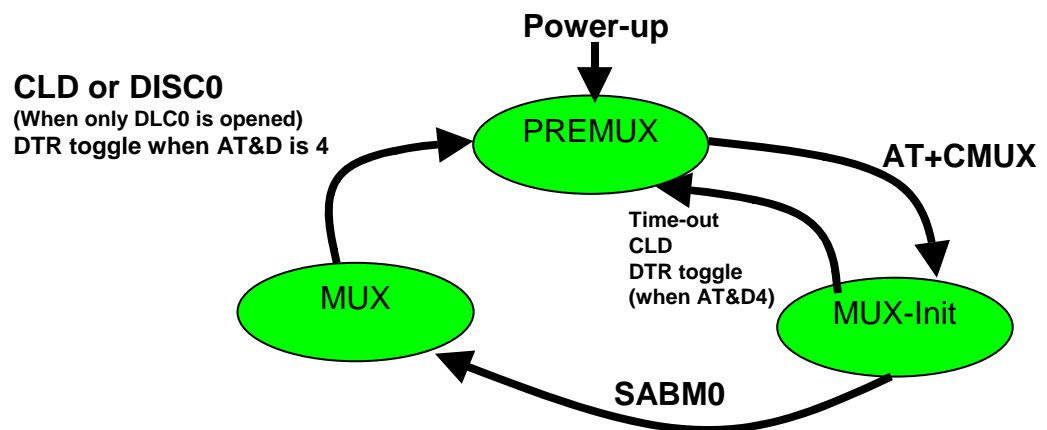


Figure 3-18: MUX States

### PREMUX State

Once GRLC logical communication channel between DTE and C24 has been established, the RS232/USB cable is connected and the DTE device is ready to communicate.

## MUX-Init State

In-between states when C24 and DTE are moving from PREMUX to MUX. This state has two parts:

- The 1st part is a very short period part when C24 is getting ready to communicate with DTE over MUX protocol.
- The 2nd part is when C24 is ready and waits for DTE to begin using the MUX protocol by sending a special low-level byte sequence (SABM0 Frame).

### Enter to state:

- When C24 receives the AT+MMUX command and return a success response (OK).

### Exist from state:

- Timeout after for 10 sec the C24 didn't receive a SABM0 frame.  
Then the C24 returns from this State to PREMUX.
- If the RS232/USB connection is closed, then the C24 returns from this State to PREMUX.
- Upon SABMO frame is received, C24 moves to MUX state.

**Note:** In this state there are no C24 indications and AT commands such as RING indicator (RI), etc.

## MUX State

DTE and C24 are communicating with MUX 27.010 protocol stack over RS232/USB.

**Enter to state:** When C24 receives the SABM0 Frame.

**Exist from state:** when the DTE requests the C24 to return to PREMUX State.

## Supported 27.010 Protocol Services

The Multiplexer Protocol is implemented according to 3GPP TS 27.010.

The following 27.010 MUX protocol services are NOT supported by C24 module: PN, RPN, RLS, SNC, and PSC.

**Note:** The Sleep Mode mechanism (S24,S100, S102) is working instead of PSC also in MUX mode.

The following table describes some services defined in the 27.010 protocol that are supported by the MUX feature.

Service	Description
<b>Start Up</b>	Used to start the multiplexer operation over the serial channel.
<b>DLC Establishment Services</b>	Used to open virtual multiplexer channels.
<b>DLC Release Services</b>	Used to disconnect a DLC exclude control channel (DLCO).



Service	Description
<b>Close Down Services (CLD, DISCO, Exception situations)</b>	Used to terminate multiplexer operation on the serial channel and resume GRLC operation (returns to PREMUX state).
<b>Control Services</b>	<p>Includes services at the MUX entity level and at the specific DLC level.</p> <p>MUX Entity Level services (channel 0): Test Service used to test the communication link between two MUX entities.</p> <p>Specific DLC Level services (all DLC except 0):</p> <ol style="list-style-type: none"> <li>1. A specific DLC HW modem status is reflected by logical (SW) means. A Modem Status Command (MSC) is used to control specific DLC modem signals, as a substitute for the HW lines in PREMUX. Initial values are expected to mirror the HW values in PREMUX.</li> <li>2. If "FC" bit in MSC command is set, C24 MUX stops to send data on a corresponding to a DLCI field virtual channel. Otherwise C24 MUX starts to send data on a corresponding to a DLCI field virtual channel. The C24 MUX replies to a terminal with received MSC command. Note: The MSC break signal, RTS, CTS are not supported.</li> <li>3. "Non Supported Command" response: NSC frame</li> </ol> <p>For more description about MSC UIH Control Frame - Virtual Channel V.24 signals refer to <a href="#">"MUX" on page B-1</a>.</p>

## MUX over UART

### UART Flow Control

C24 supports automatic UART hardware flow control.

Software flow control at the physical UART level is supported while MUX is in advanced mode. It is not supported in basic mode.

### MUX UART Port Speed

To set the UART baud rate, the C24 uses the <port speed> parameter in +MMUX command. If the parameter is absent, the MUX uses the same baud rate that was in PREMUX state.

AT commands such as +CBAUD and +IPR may change the virtual baud rate for an IDLC where one of the commands was sent. AT+CBAUD? or AT+IPR? return the virtual baud rate value of the specific IDLC. The AT+MMUX? returns physical UART baud rate.

## Physical RS232 lines in MUX

### RI HW Line

When MT call arrived, The RI line behavior is the same as in PREMUX state.

### DCD HW Line

In MUX and MUX-Init states DCD will be always inactive. There is no use for this line within MUX.

### DTR HW Line

Procedure upon DTR is dependent of the settings of AT&D in PREMUX state (GRLC profile).

If PREMUX AT&D setting was 4, while in MUX or MUX-INIT state and DTR is toggled, C24 will return to PREMUX state. Upon return C24 will release any call (1x data call, CSD, FAX) except for a voice call.

**Note:** If in PREMUX AT&D setting was NOT 4, C24 will ignore the DTR without any operation.

## +MMUX, MUX Startup Command

This command is used to enable/disable the MUX multiplexing protocol stack. When C24 receives a valid AT+MMUX command it returns OK and changes its state to MUX-INIT. If the parameters are left out, the default value is used.

Command Type	Syntax	Response/Action	Remarks
Set	+MMUX=<mode> [,<subset>[,<port_speed> [,<N1>[,<T1>[,<N2>[,<T2>[,<T3>[,<k>]]]]]]]]	OK or +CME ERROR: <err>	The Set command requests the C24 to open the MUX stack with various parameters. This command works only in PREMUX state.

Command Type	Syntax	Response/Action	Remarks
Read	+MMUX?	+MMUX: <mode>, [<subset>], <port_speed>, <N1>, <T1>, <N2>, <T2>, <T3>+CME ERROR: <err>	The Read command displays the current mode and settings. This command works only in MUX state.
Test	+MMUX=?	+MMUX: (list of supported <mode>s), (list of supported <subset>s), (list of supported <port_speed>s), (list of supported <N1>s), (list of supported <T1>s), (list of supported <N2>s), (list of supported <T2>s), (list of supported <T3>s), (list of supported <k>s)	The Test Command displays a list of supported modes and parameters. This command works in both PREMUX and MUX states.

The following table shows the +MMUX parameters.

**Table 3-237: +MMUX Parameters**

<Parameter>	Description
<mode>	MUX mode: 0 Basic 1 Advanced The default value is "0"
<subset>	Defines how the MUX control channel is set up. The virtual channel is set up according to this setting. 0 UIH frames used only
<port_speed>	Transmission rate: 1- 9600 2- 19200 3- 38400 4- 57600 5- 115200 6- 230400
<N1>	Maximum frame size: 31 256 The default value is 31 in Basic mode, 64 in Advanced mode.
<T1>	Acknowledgement timer (in units of 10 ms). 1-255 Default value is 10 (100 ms)
<N2>	Maximum number of retransmissions. 0-100 Default value is 3
<T2>	Response timer for the DLC0 (in units of 10 ms). <T2> must be longer than <T1>. 2-255 Default value is 30 (300 ms)
<T3>	Wake up response timer (in seconds). 1-255 Default value is 10.

**Note:** Due to non-ERM, the <k> parameter is not supported.

## MUX Modes

The <mode> parameter in the AT+MMUX command determines whether the MUX protocol works in basic mode or advanced mode including the transparency mechanism.

When the C24 changes PREMUX to MUX-Init state, the C24 will open the MUX stack in the selected mode.

In Advanced mode the following requirements apply:

- The length field can no longer be a part of the new frame structure.
- A transparency mechanism.
- XON/XOFF flow control is available.

## MUX Channels

### Basic MUX Channel Definitions

- Each MUX channel functions as a regular RS232 connection that follows 3GPP 27.007 and ITU V.25 standards. However, there are some limitations, as described in this paragraph.
- The C24 IDLC channel switches to Data mode as specified in 3GPP 27.007.
- When the MUX protocol layer releases the IDLC channel, any HSP/SC Data session or established call is hung up. Only active voice calls remain connected.
- AT command requests by an IDLC may result in an ERROR, while in PREMUX state the same request would never have returned an ERROR. This may happen because the addressed resource in the C24 is busy with a second IDLC request. For example, if two channels send the AT+CLIP? command, which addresses the GSM engine, only one channel receives the +CLIP: response, while the other receives an ERROR.

### Channel Priorities

The control channel has the highest priority. All other IDLCs have the same priority.

**Note:** All control frames are processed before any other channels. IDLC frame validation is also performed after all control frames are processed.

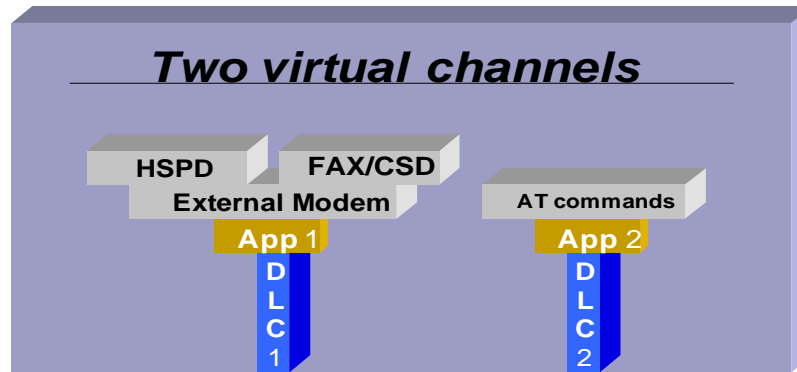
## Multiple Channel Configuration

The configurations listed below are recommended to achieve maximum use of parallel channels with minimum conflicts.

### Two Channel Configuration

- DLC1 – Data channel dedicated to CDS

- DLC2 – ACCH (AT command channel; includes all AT commands except CDS related commands)

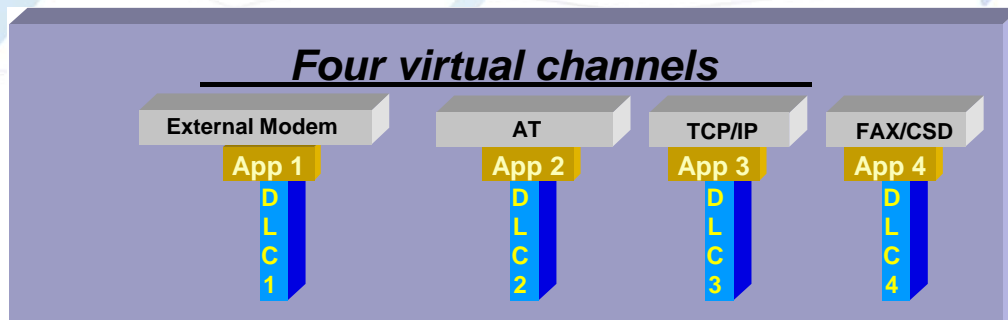


**Figure 3-19: Two-channel Configuration**

**Note:** Between data sessions, DLC1 is IDLE (in command mode).

### Four-channel Configuration

- DLC1 – External Modem
- DLC2 – Command Mode
- DLC3 – TCP/IP
- DLC4 – CSD/FAX



**Figure 3-20: Four-Channel Configuration**

Between sessions the TCP/IP and FAX/CSD channels, will be IDLE (command mode).

**Note:** In this configuration the DTE device might try to request some CDS service simultaneously. For example, it may try to establish a CSD session in DLC1 and in DLC4, this wont work and the corresponding effect is not predictable.

## IDLC Modem Profile in MUX State

### Definitions

- Modem profile - C24 modem settings such as s-registers and flex values.
- GRLC profile - GRLC (PREMUX) settings such as s-registers and flex values.
- GRLC default profile - GRLC (PREMUX) settings on power up.
- When a new channel is established (open IDLC) its modem profile will be the GRLC default profile.
- When the C24 returns to PREMUX state from either MUX or MUX-INIT states, its modem profile is the GRLC default profile.
- UART port speed and flow control (AT&K and AT+CBAUD/AT+IPR) - If an IDLC tries to change the settings it receives an OK response due to backward compatibility, but the real value of the physical channel is NOT changed. When the C24 returns to PREMUX state these two parameters will return to the GRLC default profile (power up profile values).

### AT Commands per Channel Configuration

The following table provides the AT commands that are allowed for each channel.

When DTE sends a "Not allowed" AT command to a specific channel ERROR response will be returned.

Use the following legend for the Profile Definition column in the table below:

- PCHS: Per channel setting
- PMS: Per Mobile Settings

**Table 3-238: AT Commands Limitations for 4-Channel Configuration**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+CGMI	√	√	√	√	
+GMI	√	√	√	√	
+FMI	√	√	√	√	
+CGMM	√	√	√	√	
+GMM	√	√	√	√	
+FMM	√	√	√	√	
+CGMR	√	√	√	√	
+GMR	√	√	√	√	
+FMR	√	√	√	√	
+CGSN	√	√	√	√	

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+GSN	√	√	√	√	
+MPESND	√	√	√	√	
+MPESNH	√	√	√	√	
+UMID	√	√	√	√	
+CSCS		√			
+CIMI	√	√	√	√	
+CFSN	√	√	√	√	
I	√	√	√	√	
\$	√	√	√	√	
+CLAC	√	√	√	√	
D	√	√	√	√	
D>	√	√	√	√	
DL	√	√	√	√	
H	√	√	√	√	
A	√	√	√	√	
+MARS		√			
+MARD		√			
\$QCCAV		√			
+CHV		√			
+CDV		√			
+CRC	√	√	√	√	PCHS
RING	√	√	√	√	PCHS
+CRING	√	√	√	√	PCHS
O	√	√	√	√	PCHS
+COLP		√			
+CSO	√	√	√	√	PMS
+MDC		√			
+MFIC		√			
+MFOC		√			
+MAIF		√			
+CLIP		√			
+CCWA		√			

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+CLIR		√			
+CPAS		√			
+CLCC		√			
+MCST		√			
+MVPRI		√			
+MECALL		√			
+CSMS		√			
+CPMS		√			
+CMGF		√			
+CSDH		√			
+CSMP		√			
+CNMI		√			
+CMTI		√			
+CMT		√			
+CNMA		√			
+CDSI		√			
+CDS		√			
+CMGL		√			
+MMGL		√			
+CMGR		√			
+MMGR		√			
+MMAR		√			
+CMSS		√			
+CMGW		√			
+CMGD		√			
+CMGS		√			
+CREG		√			
+CSQ		√			
+MSSI		√			
+NETPAR		√			
+MDISP		√			
+MDORMANT		√			



**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+MPREFMODE		√			
+MBANDP		√			
+CLAN		√			
+CMER		√			
+CIEV		√			
+MMR		√			
+MMRR		√			
+CIND		√			
+MPIN		√			
A/	√	√	√	√	PCHS
AT	√	√	√	√	PCHS
+CPIN		√			
+EPIN		√			
+TPIN		√			
+CPWD		√			
+CLCK		√			
+MMRU		√			
+CPBS		√			
+CPBR		√			
+CPBF		√			
+CPBW		√			
+CSVM		√			
+CCLK		√			
+FCLASS	√			√	PMS
+FDT	√			√	PMS
+FDR	√			√	PMS
+FKS	√			√	PMS
+FIP	√			√	PMS
+FAA	√			√	PMS
+FAP	√			√	PMS
+FBO	√			√	PMS
+FBS	√			√	PMS

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+FBU	√			√	PMS
+FCC	√			√	PMS
+FCQ	√			√	PMS
[+FCR]	√			√	PMS
+FCT	√			√	PMS
+FEA	√			√	PMS
+FFC	√			√	PMS
+FHS	√			√	PMS
+FIE	√			√	PMS
+FIS	√			√	PMS
[+FLI]	√			√	PMS
+FLO	√			√	PMS
+FLP	√			√	PMS
[+FMS]	√			√	PMS
+FNR	√			√	PMS
+FNS	√			√	PMS
+FPA	√			√	PMS
[+FPI]	√			√	PMS
+FPR	√			√	PMS
[+FPS]	√			√	PMS
+FPW	√			√	PMS
[+FRQ]	√			√	PMS
+FRY	√			√	PMS
+FSA	√			√	PMS
[+FSP]	√			√	PMS
\$QCSCRM	√	√	√	√	PMS
\$QCMDR	√	√	√	√	PMS
\$QCDMR	√	√	√	√	PMS
+GOI	√	√	√	√	PMS
+GCAP		√			
&C	√	√	√	√	PCHS
&D	√	√	√	√	PCHS

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+CBC		√			
+CBAUD	√	√	√	√	PCHS
+IPR	√	√	√	√	PCHS
&K	√	√	√	√	PCHS
+CFUN		√			
S97		√			
+MRST	√	√	√	√	
+MIOC		√			
+MIOD		√			
+MMAD		√			
+MIPCALL			√		
+MIPOPEN			√		
+MIPCLOSE			√		
+MIPSETS			√		
+MIPSEND			√		
+MIPPUSH			√		
+MIPFLUSH			√		
+MIPRUDP			√		
+MIPRTCP			√		
+MIPSTAT			√		
+MIPXOFF			√		
+MIPXON			√		
+MIPCONF			√		
+MPING			√		
+MPINGSTAT			√		
+MSDNS			√		
+MIPCFF			√		
+MIPSSL			√		
+MIPODM			√		
+MIPDATA			√		
+MIPCSC			√		
\$QCPREV			√		

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
V	√	√	√	√	PCHS
Q	√	√	√	√	PCHS
E	√	√	√	√	PCHS
X	√	√	√	√	PCHS
S0	√	√	√	√	PCHS
S2	√	√	√	√	PCHS
S3	√	√	√	√	PCHS
S4	√	√	√	√	PCHS
S5	√	√	√	√	PCHS
S7	√	√	√	√	PCHS
S8	√	√	√	√	PCHS
S12	√	√	√	√	PCHS
VS	√	√	√	√	PCHS
?	√	√	√	√	PCHS
&F	√	√	√	√	PCHS
Z	√	√	√	√	PCHS
&V	√	√	√	√	PCHS
&W	√	√	√	√	
&Y	√	√	√	√	
S24		√			
S102		√			
S100		√			
+MSCTS		√			
+MNAM		√			
+MNAM2		√			
+MNAM3		√			
+SNAM		√			
+CPRL1		√			
+CPRL2		√			
+CPRL3		√			
+CPRL4		√			
+MPRISUM		√			

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+CMEE	√	√	√	√	PCHS
+CEER		√			
+MSPC	√	√	√	√	
+MREFLASH	√	√	√	√	
\$QCMIPNAI	√	√	√	√	PMS
\$QCMIPPHA	√	√	√	√	PMS
\$QCMIPSHA	√	√	√	√	PMS
\$QCMIPHA	√	√	√	√	PMS
\$QCMIPMHSS	√	√	√	√	PMS
\$QCMIPMASS	√	√	√	√	PMS
\$QCMIPMHSPi	√	√	√	√	PMS
\$QCMIPMASPI	√	√	√	√	PMS
\$QCMIPRT	√	√	√	√	PMS
\$QCMiPEP	√	√	√	√	PMS
\$QCMIPGETP	√	√	√	√	PMS
\$QCQNC	√	√	√	√	PMS
\$QCTRTL	√	√	√	√	PMS
\$QCSO	√	√	√	√	PMS
\$QCMIPT	√	√	√	√	PMS
\$QCMIPP	√	√	√	√	PMS
\$QCMIP	√	√	√	√	PMS
\$QCVAD	√	√	√	√	PMS
+CTA	√	√	√	√	PMS
+CAD	√	√	√	√	PMS
+CDR	√	√	√	√	PMS
+CDS	√	√	√	√	PMS
+CRM	√	√	√	√	PMS
+CQD	√	√	√	√	PMS
+CMIP	√	√	√	√	PMS
+CBIP	√	√	√	√	PMS
+CMUX	√	√	√	√	PMS
+CFG	√	√	√	√	PMS

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+CXT	√	√	√	√	PMS
+MV18S	√	√	√	√	PMS
+MV18R	√	√	√	√	PMS
+MS	√	√	√	√	PMS
+ETBM	√	√	√	√	PMS
+ESR	√	√	√	√	PMS
+ES	√	√	√	√	PMS
+ER	√	√	√	√	PMS
+DS	√	√	√	√	PMS
+DR	√	√	√	√	PMS
+EFCS	√	√	√	√	PMS
+CRSL		√			
+CLVL		√			
+CMUT		√			
S94		√			
S96		√			
+MAPATH		√			
+MAVOL		√			
+MAMUT		√			
+MAFEAT		√			
+MADIGITAL		√			
+CALM		√			
+MDMIC		√			
+MMICG		√			
+CRTT		√			
+VTD		√			
+VTS		√			
+MAMOD		√			
+MFOTACNFG		√			
+MFOTAREQ		√			
+MFOTARSP		√			
+MFOTAINSTL		√			

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
+MFOTAABORT		√			
+MFOTAIND		√			
+MFOTARLBCK		√			
+MFOTASTART		√			
+MODDC		√			
+MODPRL		√			
+MODFUMO		√			
+MODCI		√			
+MODNI		√			
+MODIND		√			
+MOTAIND		√			
+MGPSMODE		√			
+MGPSLOC		√			
+MGPSLUPD		√			
+MGSPSPDEIP		√			
+MGSPSPDEIP		√			
+MGPSMPCIP		√			
+MGPSPROT		√			
+MGPSRES		√			
+MGPSQoS		√			
+MNMEA		√			
\$PMOTG		√			
+MMUX		√			
\$QCCLR	√	√	√	√	PMS
+ILRR	√	√	√	√	PMS
+ICF	√	√	√	√	PMS
+IFC	√	√	√	√	PCHS
+MTTY		√			
+MTIME		√			
\$SPMDN		√			

**Table 3-238: AT Commands Limitations for 4-Channel Configuration (Cont.)**

AT CMD	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Profile Definition
	External Modem	Command mode	TCP/IP	CSD/FAX	
\$SPMSID		√			
\$SPFWREV		√			
\$SPMIPERR		√			
\$SPSPC		√			PMS
\$SPPRL		√			
\$SPSERVICE		√			
\$SPSIGDBM		√			
\$SPCURRENTLOCK		√			
\$SPROAM		√			
\$SPERI		√			
\$SPRMGUARD		√			
\$SPLOCATION		√			
\$SPGETLOCATION		√			
\$SPNMEA		√			
\$SPRESET		√			
L	√	√	√	√	
M	√	√	√	√	
P	√	√	√	√	

**Note:**

- When the call type is unrecognized, it is considered as a voice call. In such a case, RING will be sent to IDLC-2 only.
- Hung Up (ATH/AT+CHV) is possible via the same IDLC that call was answered in.
- ATA command for MT CSD call via one of proper IDLC causes to NO CARRIER message via another one.
- In case of two-channel configuration, IDLC1 and IDLC2 are available.



## Multiple Channel Definitions

The following table provides various multiple channel definitions.

**Table 3-239: Multiple Channel Definitions**

Term	Description
<b>Command response</b>	A response to a command is delivered back to the channel from which the command was sent.
<b>Unsolicited indication</b>	Unsolicited indications are sent only to the channel that enabled them.
<b>AT+MMUX command</b>	Any C24 IDLC receiving an AT+MMUX command returns an ERROR response – +CMEE: "operation not allowed".
<b>Common settings for all channels</b>	Settings that are not stored in the IDLC modem profile, but that are set in one of the C24 components. Any modification to these settings overrides the previous settings in all the other channels. For example, Database settings (phonebook, Flex, audio settings, network (SIM) settings, and so on. For this reason, parallel commands are not allowed in more than one channel. All the settings that are private for each channel (can be different in different channels) are mentioned in the Profile Definition column in <a href="#">Table 3-238</a> .

## Interface Commands

### \$QCCLR, Clear Mobile Error Log

This command clears the mobile error log.

Command Type	Syntax	Response/Action	Remarks
Set	\$QCCLR	\$QCCLR: OK	
Test	\$QCCLR=?	\$QCCLR: OK	

### +ILRR, TE2-MT2 Local Rate Reporting

This extended-format numeric parameter controls whether the extended-format +ILRR:<rate> information text is transmitted from the MT2 to the TE2.

Command Type	Syntax	Response/Action	Remarks
Read	AT+ILRR	+ILRR:<rate> OK	<rate> equal to 0 permanently.

### +ICF, TE2-MT2 Character Framing

This extended-format compound parameter determines the local serial port start-stop (asynchronous) character framing that the MT2 uses while accepting TE2 commands, and while transmitting information text and result codes to the TE2, if this is not determined automatically. (Refer to “+IPR, Local Terminal/C24 Serial Port Rate” on page 3-138).

Command Type	Syntax	Response/Action	Remarks
Execute	AT+ICF	OK	Set the char framing to it's default values: <value1>=3 <value2>=3
Set	AT+ICF =<value1>,<value 2>	OK or: +CME ERROR: <err>	Set the character framing that the MT2 uses while accepting TE2 commands.

Command Type	Syntax	Response/Action	Remarks
Read	AT+ICF?	+ICF: <value1>,<value2> OK	
Test	AT+ICF=?	+ICF: (list of supported<value1>),(lis t of supported <value2>) OK	

The following table shows the +ICF parameters.

**Table 3-240: +ICF Parameters**

<Parameter>	Description
<level1>	3 only.
<level2>	0 to 3

#### Example

```

AT+ICF?
+ICF: 3,3
OK
AT+ICF=?
+ICF: (3-3),(0-3)
OK
AT+ICF=3,1
OK
AT+ICF?
+ICF: 3,1
OK

```

## +IFC, Terminal-C24 Local Flow Control

This parameter controls the operation of the local flow control between the terminal and the C24 during the data state when V.42 error control is used, or when fallback to non-error control mode is specified to include buffering and flow control. It accepts two numeric subparameters:

- <DCE\_by\_DTE>: Specifies the method to be used by the terminal to control the flow of received data from the C24.
- <DTE\_by\_DCE>: Specifies the method to be used by the C24 to control the flow of transmitted data from the terminal.

The implementation of this parameter is mandatory if V.42 error control or Buffered mode is provided in the C24. If not, it is optional. C24s which do not implement circuit 106 and/or circuit 133 do not need to support the value 2 for the corresponding subparameter.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+IFC=[[<DCE_by_DTE>],[DTE_by_DCE>]]	<b>OK</b> or: <b>+CME ERROR: &lt;err&gt;</b>	
<b>Read</b>	AT+IFC?	<b>+IFC:</b> <DCE_by_DTE>,<DTE_by_DCE>	
<b>Test</b>	AT+IFC=?	<b>+IFC: (list of supported &lt;DCE_by_DTE&gt;s, list of supported &lt;DTE_by_DCE&gt;s)</b>	

The following table shows the <DCE\_by\_DTE> and <DTE\_by\_DCE> parameters.

**Note:** <DCE\_by\_DTE> and <DTE\_by\_DCE> of the same value only are supported.

**Table 3-241: <DCE by DTE> and <DTE by DCE> Parameters**

<Parameter>	Description
<b>&lt;DCE_by_DTE&gt;</b>	0 None 1 DC1/DC3 on circuit 103. Do not pass DC1/DC3 characters to the remote DCE. 2 Circuit 133 (ready for receiving). 3 DC1/DC3 on circuit 103 with DC1/DC3 characters being passed through to the remote C24 in addition to being acted upon for local flow control. 4-127 Reserved for future standardization. Other Reserved for manufacture-specific use. The default is 2. DC1 is IA5 1/1. DC3 is IA5 1/3.
<b>&lt;DTE_by_DCE&gt;</b>	0 None 1 DC1/DC3 on circuit 104. 2 Circuit 106 (clear to Send/Ready for Sending). 3-127 Reserved for future standardization. Other Reserved for manufacture-specific use. The default is 2. DC1 is IA5 1/1. DC3 is IA5 1/3.

### Example

```

AT+IFC=?
+IFC: (0-3),(0-2)
OK
AT+IFC?
+IFC: 2,2
OK
AT+IFC=2,2
OK

```

## +MTTY, Motorola TTY Configuration

This AT command is used to enable or disable TTY (Tele Typewriter) support in C24 modules.

**Note:** Tele-typewriter or Teletype, a typewriter with an electronic communication. TTY is an electronic device for text communication via a telephone line, used when one or more of the parties have hearing or speech difficulties.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT+MTTY=&lt;n&gt;</b>	<b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The SET command is used for setting the current TTY mode.
<b>Read</b>	<b>AT+MTTY?</b>	<b>+MTTY : &lt;n&gt;</b> <b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The READ command returns the current TTY mode <n>.
<b>Test</b>	<b>AT+MTTY=?</b>	<b>+MTTY : (0-3)</b> <b>OK</b> <b>or:</b> <b>+CME ERROR: &lt;err&gt;</b>	The Test command returns the possible value's range.

The following table shows the +MTTY parameters.

**Table 3-242: +MTTY Parameters**

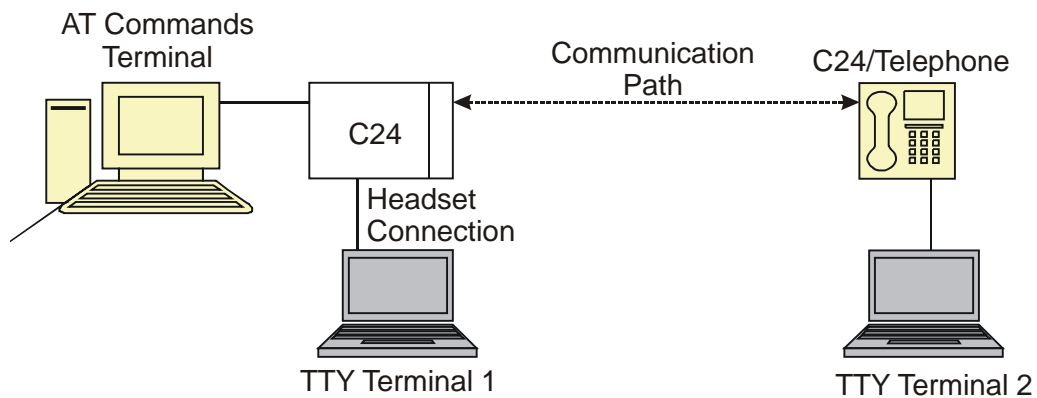
<Parameter>	Description
<b>&lt;n&gt;</b>	<p>0 Normal voice mode.</p> <p>1 Full TTY mode (both uplink and downlink support TTY data; used when both side parties are deaf).</p> <p>2 VCO mode (Voice Carry Over- uplink is voice active downlink is TTY).</p> <p>3 HCO mode (Hearing Carry Over-downlink is voice active uplink is TTY).</p> <p><b>The default value:</b></p> <ul style="list-style-type: none"> <li>On Power Up - as previously saved in FLEX bytes.</li> <li>Before set command is first used, mode is set to Normal voice call.</li> </ul>

### Notes:

**VCO:** Voice Carry Over is intended for people who cannot hear but are able to speak clearly. During a VCO relay call, the Deaf or Hard-of-Hearing caller speaks directly to the person they are conversing with. When that person responds, a Communication Assistant (CA) will type back exactly what is said and it will appear on the screen of your TTY or VCO phone.

**HCO:** Hearing Carry Over allows Speech Disabled callers who can hear well on the telephone to listen directly to the person they are talking with. The Speech Disabled Relay user types his or her part of the conversation on a TTY. A Communication Assistant (CA) then speaks the typed conversation, word for word, to the standard telephone user.

Figure 3-21 shows the TTY hardware configuration.



**Note:** TTY terminal 1 is connected to C24 via headset connector.

**Figure 3-21: TTY Hardware Configuration**

#### Example

```
AT+MTTY=?  
+MTTY: (0-3)  
OK
```

```
AT+MTTY=1  
OK
```

```
AT+MTTY?  
+MTTY: 1  
OK
```

## Timers

### +MTIME- Display Internal Timers

This command returns 3 types of accumulated internal timers as reported by the module.

The three types are:

- Lifetime Voice Minutes.
- Lifetime Number of Calls Made.
- Lifetime Data.

**Note:** This command reads the internal timers of the module.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	AT+MTIME=<timer>	+MTIME: <accumulated value> OK or ERROR: <error_code>	
<b>Test</b>	AT+MTIME=?	+MTIME: <list of supported timer> OK or ERROR: <error_code>	

The following table shows the +MTIME parameters.

**Table 3-243: +MTIME Parameters**

<Parameter>	Description
<timer>	0 - Lifetime Voice Minutes - The total minutes of use. 1 - Lifetime Number of Calls Made - The total number of voice calls. 2 - Lifetime Data - The total amount of data usage in kilobytes.
<accumulated value>	Accumulated internal timers as reported by the module.

#### Example

```
AT+MTIME = 1
OK
+MTIME: 35120
```

## Enhanced AT commands

### \$SPMDN, Read MDN

This command reads the 10 digits phone number.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPMDN?	\$SPMDN: <mdn> OK	

The following table shows the \$SPMDN parameters.

**Table 3-244: \$SPMDN Parameters**

<Parameter>	Description
<mdn>	10 digits phone number.

#### Example

```
AT$SPMDN?  
OK  
$SPMDN: 9135551212
```

### \$SPMSID, Read MSID (IMSI\_S)

This command reads the 10 digits phone number.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPMSID?	\$SPMSID: <msid> OK	

The following table shows the \$SPMSID parameters.

**Table 3-245: \$SPMSID Parameters**

<Parameter>	Description
<msid>	10 digits phone number.

#### Example

```
AT$SPMSID?  
OK  
$SPMSID: 9135551212
```



## \$SPFWREV, Read FW Version

This command reads the current Firmware version.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPFWREV?	\$SPFWREV: <current FW version> OK	

## \$SPMIPERR, Last MIP Error

This command retrieves the last MIP error from the device.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPMIPERR	\$SPMIPERR: < last MIP error > OK	

## \$SPSPC, Set SPC Code

This command unlocks the SPC code, to enable access to protected areas of the device.

Once programmed, subsidy is active and can be used to enter the module service programming mode.

When set a wrong code, all programming commands will return ERROR.

If an incorrect subsidy lock is entered into the module on five consecutive attempts, the module shall power off.

Command Type	Syntax	Response/Action	Remarks
Set	AT\$SPSPC=<spc>	OK  or:  +CME ERROR: <err>	
Read	AT\$SPSPC?	\$SPSPC: <status>	

The following table shows the \$SPSPC parameters.

**Table 3-246: \$SPSPC Parameters**

<Parameter>	Description
<spc>	6 digits of programming code.
<status>	0 - Lock (default) 1 - Unlock

## \$SPPRL, Read PRL

This command reads the current PRL number from the device.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPPRL?	\$SPPRL: <prl number> OK	

## \$SPSERVICE, Read Service Area

This command reads the service to which the modem will attempt to connect.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPSERVICE?	\$SPSERVICE: <service> OK	

The following table shows the \$SPSERVICE parameters.

**Table 3-247: \$SPSERVICE Parameters**

<Parameter>	Description
<service>	0 - No service 1 - 95A 2 - 95B 3 - 1xRTT service 4 - EVDO service 5 - EVDO Rev A

## \$SPSIGDBM, Read RSSI

This command reads the current Receive Signal Strength Indicator.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPSIGDBM?	\$SPSIGDBM: <rss> OK	

**Note:** The response should be signal strength in dBm.

## \$SPCURRENTLOCK, Read Lock Code

This command reads the current device lock code.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPCURRENTLOCK?	\$SPCURRENTLOCK: <MSL code> OK	

The following table shows the \$SPCURRENTLOCK parameters.

**Table 3-248: \$SPCURRENTLOCK Parameters**

<Parameter>	Description
<MSL code>	6 digits of MSL.

## \$SPROAM, Select Roaming Preferences

This command selects the Roaming Preferences.

The default value must be set to automatic.

Command Type	Syntax	Response/Action	Remarks
Set	AT\$SPROAM=<roam pref>	OK  or:  +CME ERROR: <err>	
Read	AT\$SPROAM?	\$SPROAM: < roam pref > OK	
Test	AT\$SPROAM=?	\$SPROAM: < List of supported roam pref >	

The following table shows the \$SPROAM parameters.

**Table 3-249: \$SPROAM Parameters**

<Parameter>	Description
<roam pref>	0 - Sprint Only 1 - Automatic (default) 2 - Roaming Only

#### Example

```
AT$SPROAM?
$SPROAM: 1
OK
AT$SPROAM=2
OK
AT$SPROAM?
$SPROAM: 2
OK
```

## \$SPERI, Enhanced Roaming Indicator

This command reports the current enhanced roaming indicator.

Command Type	Syntax	Response/Action	Remarks
Read	AT\$SPERI?	\$SPERI: < enhanced roaming indicator > OK	

The following table shows the \$SPERI parameters.

**Table 3-250: \$SPERI Parameters**

<Roaming Display Number>	Roaming Display Indication
0	Roaming Indicator On.
1	Roaming Indicator Off.
2	Roaming Indicator Flashing.
3	Out of Neighborhood.
4	Out of Building.
5	Roaming - Preferred System.
6	Roaming - Available System.
7	Roaming - Alliance Partner.
8	Roaming - Premium Partner.

**Table 3-250: \$SPERI Parameters (Cont.)**

<Roaming Display Number>	Roaming Display Indication
<b>9</b>	Roaming - Full Service Functionality.
<b>10</b>	Roaming - Partial Service Functionality.
<b>11</b>	Roaming Banner On.
<b>12</b>	Roaming Banner Off.
<b>13-63</b>	Reserved for Standard Enhanced. Roaming Indicator Numbers.
<b>64-127</b>	Reserved for Non-Standard Enhanced. Roaming Indicator Numbers.
<b>128-255</b>	Reserved.

## \$SPRMGUARD, Set Roam Guard

This command enables/disables the roam guard unsolicited report.

In case this feature is enabled, an unsolicited report will be display when the device enters roaming coverage during voice or data call. The user will have the ability to terminate the voice call or data session and cancel the operation.

**Notes:**

- In case of Data roaming guard, the module will switch to command mode automatically and display the unsolicited report. The user will decide if to terminate the call or to switch back to data mode and continue the data session.
- In case of MUX mode, the data will continue and the unsolicited report will appear in channel 2 (command channel). The decision of the user (continues data transfer or stop) should be via the same iDLC where the DATA session was established.
- In case roam guard is on and the user set AT\$SPRMGUARD=1 it should be ignored for the next call attempt. After the next call is terminated the <mode> will be equal to 2.

Command Type	Syntax	Response/Action	Remarks
<b>Set</b>	<b>AT\$SPRMGUARD=&lt;mode&gt;</b>	<b>OK</b>  <b>or:</b>  <b>ERROR: &lt;error_code&gt;</b>	In case the module enter data roaming coverage: unsolicited report of: \$SPRMGUARD: "Data roaming rates may apply" will display. In case the module enter voice roaming coverage: unsolicited report of: \$SPRMGUARD: "Voice roaming rates may apply" will display.
<b>Read</b>	<b>AT\$SPRMGUARD?</b>	<b>\$SPRMGUARD: &lt;mode&gt;</b> <b>OK</b>  <b>or:</b>  <b>ERROR: &lt;error_code&gt;</b>	
<b>Test</b>	<b>AT\$SPRMGUARD=?</b>	<b>\$SPRMGUARD: &lt;list of supported mode&gt;</b> <b>OK</b>  <b>or:</b>  <b>ERROR: &lt;error_code&gt;</b>	

The following table shows the \$SPRMGUARD parameters.

**Table 3-251: \$SPRMGUARD Parameters**

<Parameter>	Description
<b>&lt;mode&gt;</b>	0 - Default 1 - Roam Guard Off 2 - Roam Guard On

## \$SPLOCATION, Enable/Disable GPS Service

This command enables/disables the GPS service.

Command Type	Syntax	Response/Action	Remarks
Set	AT\$SPLOCATION =<mode>	OK  or:  +CME ERROR: <err>	
Read	AT\$SPLOCATION?	\$SPLOCATION: <mode> OK	
Test	AT\$SPLOCATION=?	\$SPLOCATION: < List of supported mode >	

The following table shows the \$SPLOCATION parameters.

**Table 3-252: \$SPLOCATION Parameters**

<Parameter>	Description
<mode>	0 - Location services OFF. 1 - Location service ON.

## \$SPGETLOCATION, Get Location

This command returns the device current location.

Command Type	Syntax	Response/Action	Remarks
Execute	AT\$SPGETLOCATION	\$SPGETLOCATION: <latitude>,<longitude>, <HEPE>,<speed>,<# satellites>,<altitude>,<la st fix>,<heading>  or:  +CME ERROR: <err>	

The following table shows the \$SPGETLOCATION parameters.

**Table 3-253: \$SPGETLOCATION Parameters**

<Parameter>	Description
<latitude>	Latitude: -324,000,000..324,000,000 (-90°.. 90°)
<longitude>	Longitude: -648,000,000..648,000,000 (-180°.. 180°)
<HEPE>	Horizontal Estimated Position Error. Meters
<speed>	Velocity in cm/s 0..51,400
<# satellites>	Number of Visible Satellites 0..12 Number of Satellites Tracked 0..8
<altitude>	-100,000..1,800,000
<last fix>	Date and Time
<heading>	0..3599

## \$SPNMEA, Enable/Disable NMEA

This command enables or disables the NMEA stream.

Command Type	Syntax	Response/Action	Remarks
Set	AT\$SPNMEA=<mode>	OK  or:  +CME ERROR: <err>	
Read	AT\$SPNMEA?	\$SPNMEA: <mode>	
Test	AT\$SPNMEA=?	\$SPNMEA: <List of supported modes>	

The following table shows the \$SPNMEA parameters.

**Table 3-254: \$SPNMEA Parameters**

<Parameter>	Description
<mode>	0 - Enable NMEA stream. 1 - Disable NMEA stream.



When NMEA is enabled it should support the minimum values below:

**Table 3-255: NMEA Values**

<Parameter>	Description
<latitude>	Latitude: -324,000,000..324,000,000 (-90°.. 90°)
<longitude>	Longitude: -648,000,000..648,000,000 (-180°.. 180°)
<HEPE>	Horizontal Estimated Position Error. Meters
<speed>	Velocity in cm/s 0..51,400
<# satellites>	Number of Visible Satellites 0..12 Number of Satellites Tracked 0..8
<altitude>	-100,000..1,800,000
<last fix>	Date and Time
<heading>	0..3599

## \$SPRESET, Reset the module

This command reset the module (power off than power on).

Command Type	Syntax	Response/Action	Remarks
Execute	AT\$SPRESET	OK  or:  +CME ERROR: <err>	

## IGNORED (compatible only) commands

The following commands return OK, but do not execute any operation. They are only used to provide backward compatibility.

**Table 3-256: Ignored (Compatible Only) Commands**

Command	Description
<b>L</b>	Monitors the speaker loudness.
<b>M</b>	Monitors the speaker mode.
<b>P</b>	Selects pulse dialing.



## Chapter 4: Using the Commands

### Setting Up the C24 (Power On and Initial Actions)

There are two phases of connectivity for the C24:

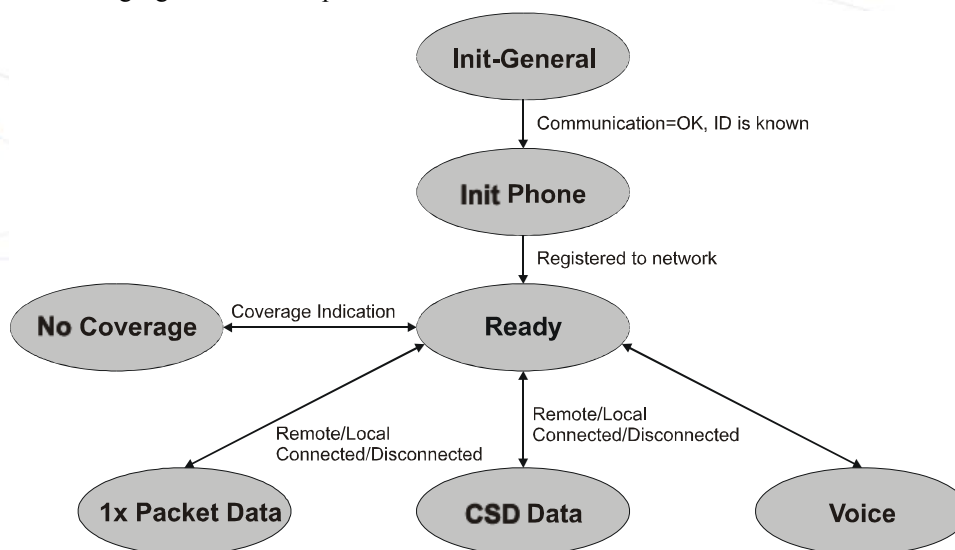
- Init General.

In this phase, the C24 is asked to provide basic information which ensures that the phone is functioning properly.

- Registering on a network in order to see that wireless access is functioning properly.

After these two phases are completed, C24 is ready for action and you can send/receive voice calls, circuit switched data and packet data calls.

The following figures show the phone state transactions:



**Figure 4-1: Phone State Transactions**

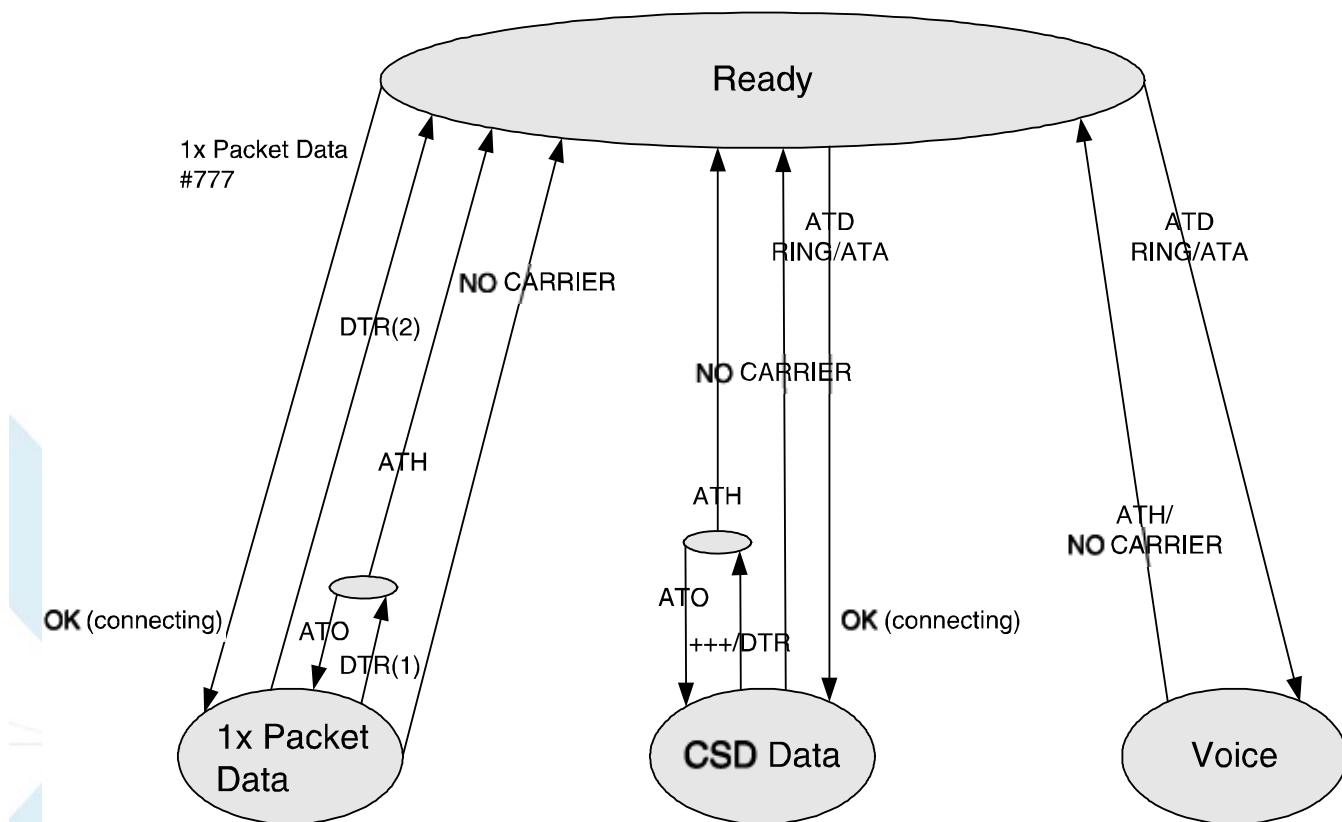


Figure 4-2: Detailed Phone State Transactions

## Recommended C24 Initialization after Powerup

Figure 4-3 provides a recommended workflow for initializing the C24 after startup. The following sections explain this workflow in detail.

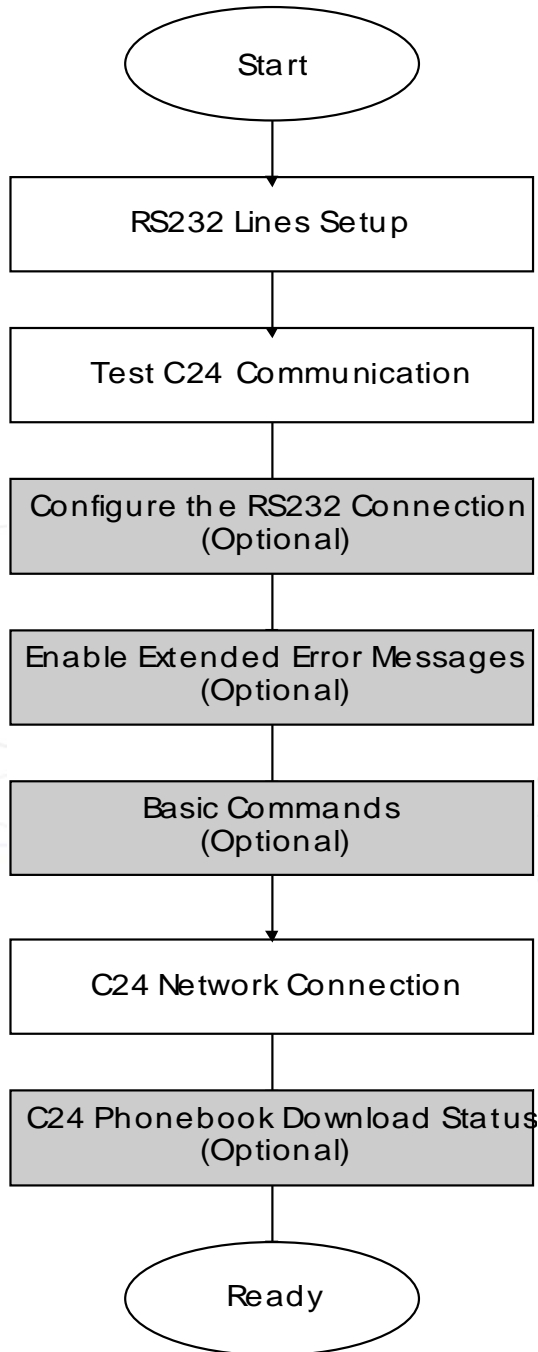
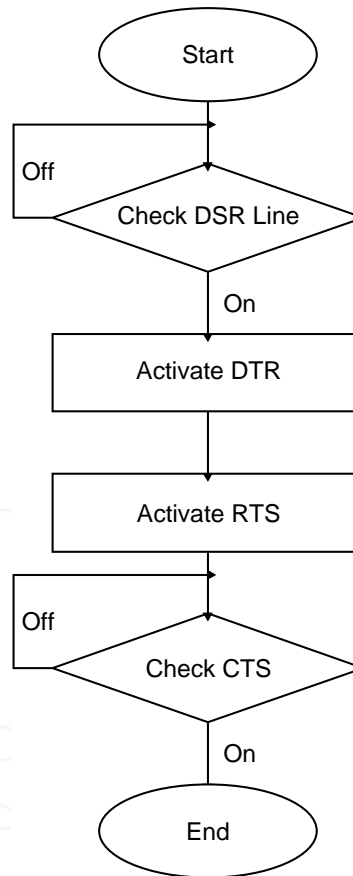


Figure 4-3: Recommended C24 Initialization Workflow

## RS232 Lines Setup

There is no dynamic detection. Upon power up, the hardware is detected. If USB is detected, then USB is selected. If USB is not connected, then the RS232 is selected. For a pin description, refer to the C24 Developer's Kit Manual: [6889192V26](#).



**Figure 4-4: RS232 Lines Setup**

## Test C24 Communication

This is a preliminary step. During this step, the ability to communicate with the C24 using AT commands is tested.

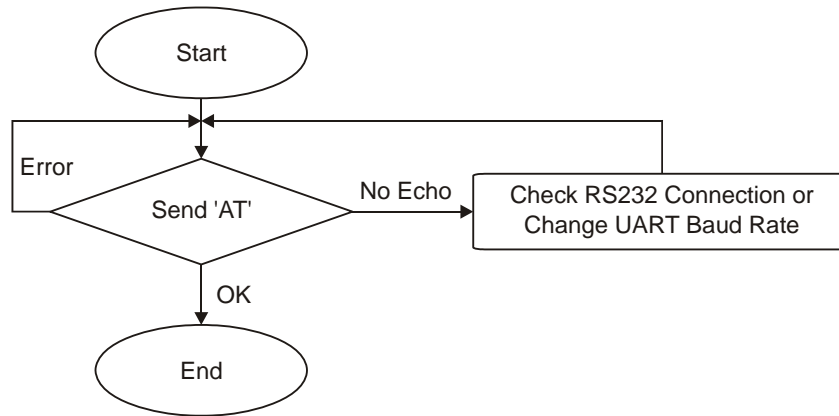


Figure 4-5: Test C24 Communication

Communication example:

AT

ATE1

//By default, the echo should be enabled

AT

OK

//Confirm that C24 replies with OK

## Basic Configuration

These are optional steps. If required, specific RS232 pin behavior can be selected. Extended error notification is recommended for debugging and field-support purposes.

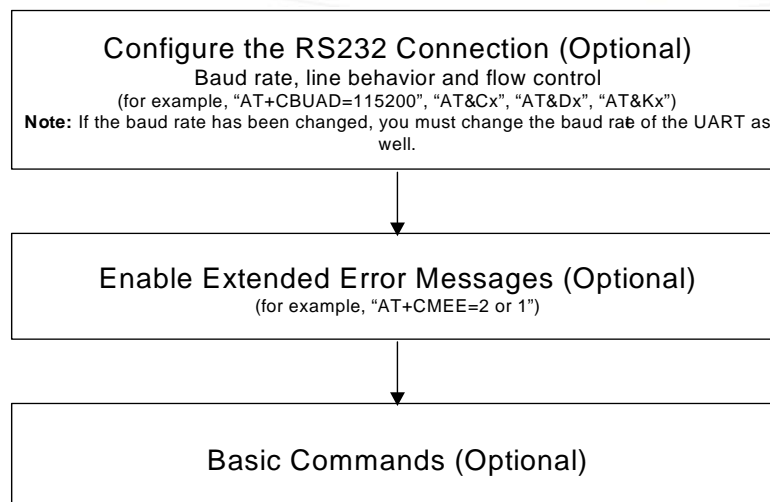


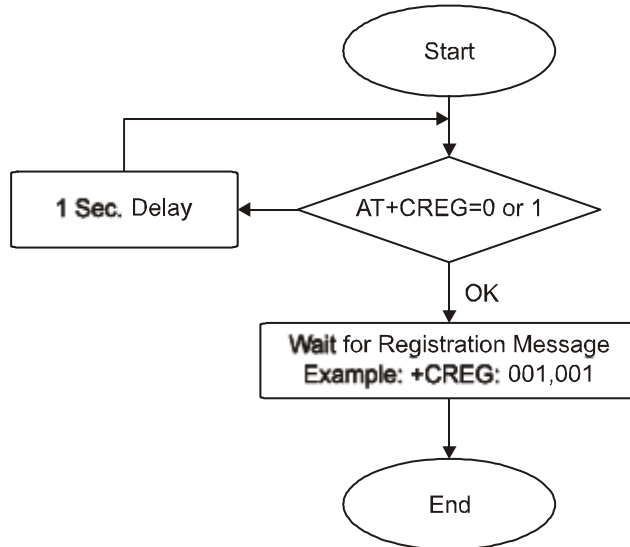
Figure 4-6: Basic Configuration

1. Baud setting example:  
`AT+CBAUD=6//Setting baud rate for 19200`  
`OK`  
`AT+CBAUD=19200//Same as issuing this command`  
`OK`
2. RS232 HW lines configuration: &C(DCD), &D(DTR), &K(flow-control).  
Default settings should be:  
`AT&C1`  
`OK`  
`AT&D2`  
`OK`  
`AT&K3`  
`OK`
3. Modem IDs (optional): +CGMI,+CGMM,+CGMR,+CGSN  
`AT+CGMI`  
`+CGMI: "Motorola"`  
`OK`  
`AT+CGMM`  
`+GMM: "CDMA800","CDMA1900","MODEL=C24"`  
`OK`  
`AT+CGMR`  
`+CGMR: "C243D18.04"`  
`OK`  
`AT+CGSN//Read the MEID number of the C24`  
`+CGSN: 448954035283579`  
`OK`
4. Error messages (optional): +CMEE, +CEER  
`AT+CMEE=2 //Enable +CME ERROR: error messages verbose string`  
`OK`  
`AT+CEER=2//Enable +CEER: call status indication verbose string`  
`OK`



## C24 Network Connection

In this step, the C24 detects existing networks (the user must register to a specific network).

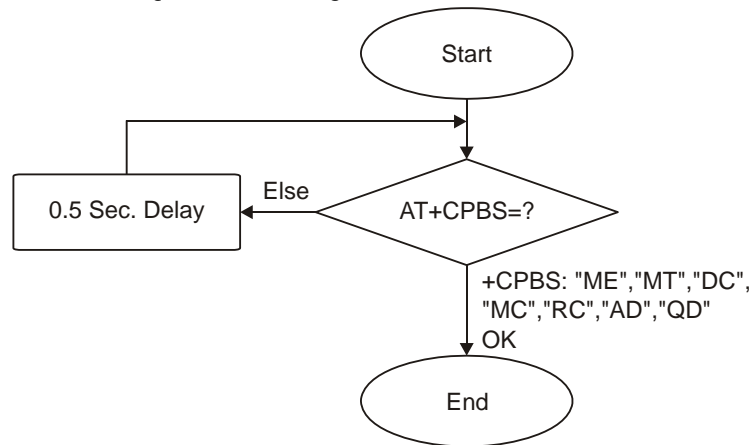


**Figure 4-7: C24 Network Connection**

1. Registration and call indications example: +CREG, +CLCC  
`AT+CREG=1`  
`OK`  
`AT+CLCC=1`  
`OK`
2. Get registration messages example: +CREG  
`AT+CGREG=1`  
`OK`  
`//Get unsolicited CDMA registration reports`  
`+CREG: 8465, 65535,1`

## Terminal Synchronization

In this step, the terminal requests the stored phonebook, SMS, and so on, from the C24.



**Figure 4-8: Terminal Synchronization**

# SMS

## Managing Stored Messages in the C24 Memory

AT+CMEE=2

OK

AT+CMGF=1

OK

AT+CPMS=?

+CPMS: ("MT","IM","ME","BM"),("ME"),("IM")

OK

AT+CPMS?

+CPMS: "MT",7,350,"ME",3,200,"IM",4,100

OK

AT+CMGL="all"

+CMGL: 254,"REC UNREAD",3,"0508524311"

kjhlkjhlkjhlkj

+CMGL: 253,"REC UNREAD",3,"0508524311"

kjshdlkajshdlkjashdlkjahlkjhlkjdhalkjdhlkajdhhlakjhlkjhlkjdlkjdhldkjhdhlakjh

+CMGL: 252,"REC READ",4,"502"

New Voice Msg From \*151 - Total 4

+CMGL: 251,"REC READ",4,"502"

New Voice Msg From \*151 - Total 3

+CMGL: 3,"STO UNSENT",3,"035655656"

ksddfklsjdhflkjshfl

+CMGL: 2,"STO SENT",3,""

kjshdlkajshdlkjashdlkjahlkjhlkjdhalkjdhlkajdhhlakjhlkjhlkjdlkjdhldkjhdhlakjh

+CMGL: 1,"STO SENT",3,""

1

OK

AT+CMGL="STO SENT"

+CMGL: 2,"STO SENT",3,""

kjshdlkajshdlkjashdlkjahlkjhlkjdhalkjdhlkajdhhlakjhlkjhlkjdlkjdhldkjhdhlakjh

+CMGL: 1,"STO SENT",3,""

1

OK

AT+CMGL="STO UNSENT"

+CMGL: 3,"STO UNSENT",3,"035655656"

ksddfklsjdhflkjshfl

## Setting the Notification Indication for Incoming Messages (Using AT+CNMI)

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```

OK
AT+CMGR=255
+CMGR: "REC UNREAD",3,"08/10/16,13:49:42","0508524311"
test

```

```
OK
```

## Another Possible Option for Setting the CNMI Notification Indication

The acknowledged message is not saved in the database. If the +CMT unsolicited response is not acknowledged within 60 seconds, the new message is saved in database.

```

AT+CNMI=3,2
OK
AT+CMGS="0508524311",3,0
> test-cnma
+CMGS: 26

OK

+CMT: 3,"08/10/16,13:50:21","0508524311"
test-cnma

AT+CNMA
OK
AT+CMGL
OK
AT+CSDH=1
OK
AT+CMGS="0508524311",3,0
> test w/o CNMA
+CMGS: 27

OK

+CMT: 3,"08/10/16,13:51:09","0508524311",129,0,,2,0,0,"0508524311",129,0,1,13
test w/o CNMA

// after 60 sec expired

AT+CMGL
+CMGL: 256,"REC UNREAD",3,"0508524311","08/10/16,13:51:09",129,13
test w/o CNMA

OK

```

## Setting TEXT Mode Parameters (Using AT+CMGW and AT+CMGS)

```
AT+CSMP=2,"09/11/04,09:48:36",0,2,0
```

```
OK
```

```
AT+CSMP?
```

```
+CSMP: 2,"09/11/04,09:48:36",0,2,0
```

```
OK
```

```
AT+CMGW=,3
```

```
> sjkhjlkjhjh
```

```
+CMGW: 4
```

```
OK
```

```
AT+CPMS="me"
```

```
+CPMS: 4,200,4,200,6,100
```

```
OK
```

```
AT+CMGR=4
```

```
+CMGR: "STO UNSENT",3,"",129,0,0,2,2,"09/11/04,09:48:36",,,,,0,2,10
```

```
sjkhjlkjhjh
```

```
OK
```

```
AT+CSMP=29,"09/11/04,09:48:36",0,2,0
```

```
+CMS ERROR: operation not supported
```

```
//wrong type of VP
```

## Writing, Saving and Sending Messages (Using AT+CMGW and AT+CMSS)

```
AT+CMGW="035655656",3,0
```

```
> ksddfklsjdhflkjshfl
```

```
+CMGW: 3
```

```
OK
```

```
AT+CMGR=3
```

```
+CMGR: "STO UNSENT",3,"035655656",129,0,0,2,0,,,,,0,2,19
```

```
ksddfklsjdhflkjshfl
```

```
OK
```

```
AT+CMSS=3
```

```
OK
```

```
AT+CMSS=3,"0508524311" //send to new destination
```

```
+CMSS: 23
```

```
OK
```

## Sending Messages (Using AT+CMGS)

AT+CMGS="0508524311",3,0

> test

+CMGS: 30

OK

AT+CMGS="0508524311",3,0,129,1,1,"035659297"

> test

+CMGS: 28

OK

## Deleting Messages (Using AT+CMGD)

AT+CMGL="all"

+CMGL: 257,"REC READ",3,"0508524311","08/10/16,14:08:31",129,4

test

+CMGL: 256,"REC READ",3,"0508524311","08/10/16,13:51:09",129,13

test w/o CNMA

+CMGL: 255,"REC READ",3,"0508524311","08/10/16,13:49:42",129,4

test

+CMGL: 254,"REC READ",3,"0508524311","08/10/16,13:38:11",129,14

kjhlkjhlkjhlkj

+CMGL: 253,"REC READ",3,"0508524311","08/10/16,13:37:23",129,79

kjshdlkajshdlkjashdlkjahlkjhlkjdhalkjdhalkajdhhlakjhlkjhlkjdlkjdhldkjhlldkjhdldakjh

+CMGL: 252,"REC READ",4,"502","08/10/15,15:19:36",129,33

New Voice Msg From \*151 - Total 4

+CMGL: 251,"REC READ",4,"502","08/10/15,15:18:52",129,33

New Voice Msg From \*151 - Total 3

+CMGL: 4,"STO UNSENT",3,"",129,10

sjkhjlkjh

+CMGL: 3,"STO UNSENT",3,"035655656",129,19

ksddfklsjdhflkjshfl

+CMGL: 2,"STO SENT",3,"",129,79

kjshdlkajshdlkjashdlkjahlkjhlkjdhalkjdhalkajdhhlakjhlkjhlkjdlkjdhldkjhlldkjhdldakjh

+CMGL: 1,"STO SENT",3,"",129,1

1





## Call Control

The following figure is a detailed view of the states the C24 goes through for Voice and CSD Data, as shown in Figure 4-2. Note that between the time the OK is received and the actual connection occurs, call state alerts are received.

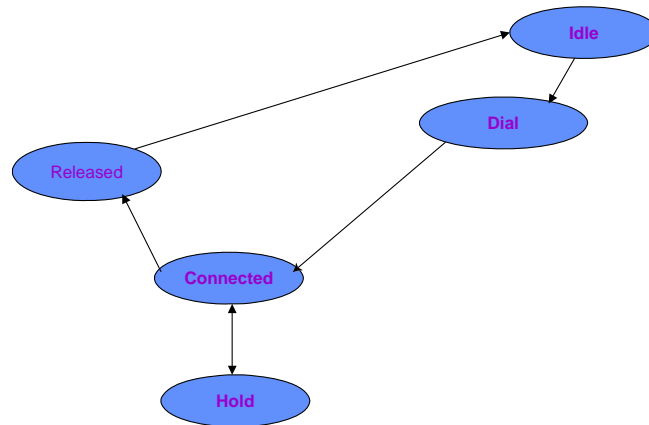


Figure 4-9: Call States

## Dialing Using ATD

<code>atd+44 34 56 78;</code>	<code>// VOICE call; number includes international access code</code>
<code>OK</code>	
<code>OK</code>	
<code>atd17085763400;</code>	<code>//Second VOICE call</code>
<code>OK</code>	
<code>OK</code>	<code>//Call to 44345678 is being put on hold</code>
<code>AT+CHV</code>	<code>//Hang up active call</code>
<code>NO CARRIER</code>	
<code>OK</code>	
<code>atd+44 34 56 78</code>	<code>//DATA call</code>
<code>...</code>	
<code>OK</code>	<code>//Move to online Data state</code>
	<code>//ESC sequence back to the Command state. +++ is sent from the</code>
<code>terminal (+++ is not displayed)</code>	
<code>ath</code>	<code>//Hang up data call</code>
<code>NO CARRIER</code>	
<code>OK</code>	<code>//Data call terminated</code>
<code>AT+FCLASS=1</code>	
<code>OK</code>	
<code>atd+44 34 56 78</code>	<code>//FAX call</code>
<code>...</code>	
<code>NO CARRIER</code>	<code>//Fax call was terminated by remote side</code>
<code>atd035659260,345,22;</code>	<code>//VOICE call with tones sent after connecting</code>
<code>OK</code>	
<code>OK</code>	

```

3 4 5 //Sent as DTMF tones
... //Pause
2 2 //Sent as DTMF tones
AT+CHV //Voice call is hung up
NO CARRIER
OK
atd0356592,60 //DATA/FAX call with comma
//Comma is ignored; 035659260 is dialed

OK

```

## Direct Dialing from Phone Book

This example uses a phone book with these pre-saved items.

```

AT+CPBS?
+CPBS: "MT" //Current phone book is now MT
AT+CPBR=1,260 //This is a specific example with memory values
+CPBR: 5,"4444",129,"BE"
+CPBR: 6,"+97235659260",145,"eran"
+CPBR: 7,"035659260",129,"eran"
+CPBR: 8,"+97251632603",145,"long"
+CPBR: 9,"5555",129,"B"
+CPBR: 77,"035619942",129,"er"
atd>"long";
OK
OK //Exact match; 051 632603 call dialed; voice call answered
atd>8;
OK
OK //Speed-dial from current phone book; 051 632603 call dialed; voice
call answered
atd>"era "
OK
OK //Prefix pattern matched; entry for "eran" was selected;
+97235659260 call dialed
atd>"er"
OK
OK
OK // Exact match; overrides prefix match; 03 5619942 call connected

```

In the next example, the current phone book is changed. The numbers are matched via a specific phone book specified in the command.

```

atd>"MT"9;
OK
NO CARRIER //Speed-dial number (using ") 5555 call dialed; number is incorrect
atd>MT;
OK
NO CARRIER //Speed-dial number 5555 call dialed, number is incorrect
atd>"MT"17
+CME ERROR: not found //Trying to dial from a non-existent entry
atd>"MT"1117
+CME ERROR: invalid index //Speed-dial number is out of range

```

## Dialing the Last Number Example

```

atd035658278;
OK
OK
AT+CHV
NO CARRIER
OK
atdl                               //Last called number is "035658278"
ATDL: "035658278"
OK                                 //DATA call
atdl;
ATDL: "035658278"
OK
OK                                 //VOICE call
atdl                               //Last called number is "035658278,123,78;"
ATDL: "035658278"
OK                                 //DATA call

```

## Voice Call Manipulations

### Call Waiting

```

AT+CCWA=1                          //Enabling the call waiting on C24
OK
AT+CDV*<FC>                        // CW may be activated by a Demand Activation authorized
                                   subscriber specifying a feature code (FC)
atd9311234567;                     //Originate a voice call
OK
OK                                 //Voice call connected
(...conversation...)
+CCWA: "+358317654321",145,1,"Bob" //Call-waiting indication received by the C24; Bob is calling
+CCWA: "+358317654321",145,1,"Bob"

```

### Call Forwarding

CF may be registered by a Variable Registration authorized subscriber specifying the CFB registration feature code and a forward-to number termination address or voice message system Modifier Digit 8, as in:

#### Idle mode

```

AT+CDV*<FC><termination address>
or
AT+CDV*<FC>8                (Voice message system).

```

#### While in a call

```

AT+MAIF=*<FC><termination address>
or
AT+MAIF=*<FC>8                (Voice message system).

```

## Three Way Call

While in a call (1st party), the MS may requests a three-way calling by sending a Flash with Information message to the BS, as in:

**AT+MAIF=<destination number 2nd party>.**

This message automatically puts the 1st party on hold.

A call is established to the third party address. When the call is answered, the MS may establish the three-way call by sending a Flash to the BS, as in:

**AT+MAIF**

Or release the 2nd party, as in:

**AT+CHV**

Alert indication (RING) is applied to the controlling subscriber for held recall.

Once a Tree Way Call is established, the MS may disconnect the 2nd party, as in:

**AT+MAIF**

Or End call, as in:

**AT+CHV**



## Changing the Character Set

### Example

When an SMS messages with the following text: "Motorola C24 OEM Module", is saved inside the C24 at entry 128, you can read it using several character sets.

When the "ASCII" character set is used, the following is received by the terminal:

```
AT+CSCS?           //Read the current character set
+CSCS: "ASCII"     //Currently using ASCII character set
OK
AT+CMGR=128        //Read SMS entry 128
+CMGR: "STO UNSENT", ""
Motorola C24 OEM Module //The content of SMS entry 128
OK
```

When the "UCS2" character set is used, the following is received by the terminal:

```
AT+CSCS?           //Read the current character set
+CSCS: "UCS2"     //Currently using UCS2 character set
OK
AT+CMGR=128
+CMGR: "STO UNSENT", ""
004D006F0074006F0072006F006C006100200067003200300020004F0045004D
0020004D006F00640075006C0065 //The content of SM entry 128
OK
```

The following is an ASCII translation of the SM contents:

004D	M
006F	o
0074	t
006F	o
0072	r
006F	o
006C	l
0061	a
0020	[space]
0063	c
0032	2
0034	4
0020	[space]
004F	O
0045	E
004D	M
0020	[space]
004D	M
006F	o
0064	d
0075	u
006C	l
0065	e

As this SMS was originally written in ENGLISH, meaning ASCII letters, each digit quadruplet starts with double zeros (00). When other languages are used, the quadruplets have different values.

## Sleep Mode

**Note:** The notation of TXD and RXD are from the perspective of the terminal unless otherwise specified.

The terminal should activate Sleep mode by sending `ATS24=n` (n - number of seconds). To disable Sleep mode, send `ATS24=0`.

### Example of C24 Entering Sleep Mode

Terminal-TX: `ATS24=n`

Terminal-TX: `ATxxx`

Terminal-Wakeup-In=Inactive//n seconds passed since last command (and other conditions met)

C24-CTS=Inactive//C24 enters Sleep mode

### Example of Terminal Wake C24 Sleep Mode

Terminal-Wakeup-In=Active

C24-CTS=Active//C24 exits Sleep mode

Terminal-TX: `ATxxx`//30 mseconds passed since Terminal-Wakeup-In became active

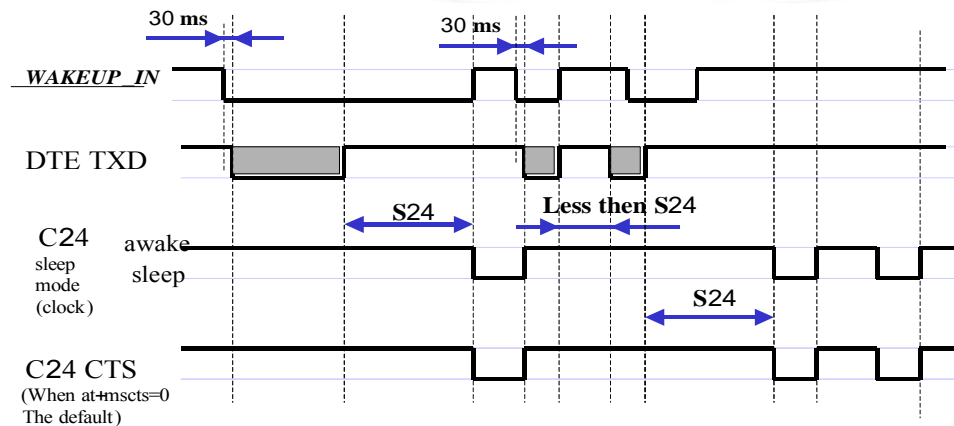
### Example of C24 Wake Terminal Up

C24-CTS=Active//C24 internal event occurred. Incoming call is pending  
//C24 exits Sleep mode

C24-Wakeup-Out=Active

C24-TX: `RING`//T mseconds passed since Terminal-Wakeup-Out became active  
(T is defined by `ATS102`.)

The figure below shows a Sleep mode example when  $S24 > 0$ .



**Figure 4-10: Sleep Mode when  $S24 > 0$**

## TCP/IP

### TCP Data Transfer Example

```

AT+MIPCALL=1,"user","password"
OK
+MIPCALL: 172.17.242.86
AT+MIPOPEN=1,1222,"123.245.213.012",1234,0 //Opening socket 1 using TCP protocol, from port 1222,
targeting 123.245.213.012 port 1234
OK
+MIPOPEN: 1,1
AT+MIPOPEN? //Terminal checking the status of socket to be opened (socket 1 opened
OK)
+MIPOPEN: 2 3 4
+MIPSETS=1,340 //Asking the C24 to accumulate 340 bytes on socket 1 prior to sending
+MIPSETS: 0
OK
AT+MIPSETS?
+MIPSETS: 1 340
OK
AT+MIPSEND=1,"444444" //Sent coded "DDD" string
+MIPSEND: 1,1497 //Free storage in the accumulating buffer
OK
Note: This step can be repeated several times until the buffer is full or until the amount of data
reaches 340 bytes and data pushed into the stack.
AT+MIPSEND? //Checking the size remaining (optional)
+MIPSEND: 1 1497
OK
+MIPPUSH=1 //Terminal asks C24 to flush the buffer in socket 1
+MIPPUSH: 0
+MIPCLOSE=1 //Terminal closes the socket
+MIPCLOSE: 1
OK
+MIPCALL=0 //Terminal hangs up the link
OK

```

### TCP Raw Data Transfer Example (Online Data Mode)

```

// create a wireless link:
AT+MIPCALL=1,"user","password"
OK

+MIPCALL: 172.17.242.86
// open a socket in Online Data Mode:
AT+MIPODM=1,1204,"123.245.213.12",1205,0
OK

+MIPODM: 1,1

```



```

// send a data from terminal to C24 via RS232 communication port:

// switch C24 to pseudo-command mode:
+++
OK

// check socket status
AT+MIPODM=?
+MIPODM 1,1

OK

// receive incoming from Network data indication (18 bytes of data comes):
+MIPDATA 1,18

// restore Online Data Mode and receive incoming from Network 18 bytes of data:
ATO
OK

CONNECT
abcdefghijklmnpqr

// switch C24 to pseudo-command mode:
+++
OK

// close the socket:
AT+MIPLOSE=1
+MIPCLOSE: 1

OK

// close the link:
AT+MIPCALL=0
+MIPCALL=0
NO CARRIER
OK


```

## Multi-point Data Transfer Example

```

AT+MIPCALL=1,"user","password"
OK
+MIPCALL: 172.17.242.86
AT+MIPOPEN=1,1001,"172.17.238.44",1001,0
OK
+MIPOPEN: 1,1
AT+MIPOPEN=2,1111,"172.17.238.44",1111,0
OK
+MIPOPEN: 2,1
+MIPSETS=1,200 //Asking the C24 to accumulate 200 bytes on socket 1 prior to sending
+MIPSETS: 0

```



```

OK
+MIPSETS=2,400           //Asking the C24 to accumulate 400 bytes on socket 2 prior to sending
+MIPSETS: 0
OK
+MIPSEND=1,"444444"
+MIPSEND:1,1497
OK
+MIPSEND=2,"DD"           //Passing data to the C24 socket 2
+MIPSEND:2,1499
OK
+MIPPUSH=1                //Terminal asks the C24 to flush the buffer in sockets 1 and 2
+MIPPUSH:0
+MIPPUSH=2
+MIPPUSH:0
+MIPCLOSE=1               //Terminal closes sockets 1 and 2
+MIPCLOSE:1
OK
+MIPCLOSE=2
+MIPCLOSE:2
OK
+MIPCALL=0                //Terminal hangs up the link
OK
+MIPSETS=1,120            //Asking the C24 to accumulate 120 bytes on socket 1 prior to sending
+MIPSETS: 0
OK
+MIPSEND=1,"444444"       //Passing 3 bytes of data to the C24 socket 1
+MIPSEND:1,1497           //Note: Size remaining in socket 1 buffer is 1497 bytes.
+MIPPUSH=1                //At this point, the terminal can decide on flushing the remainder to
the stack

```

## Xoff and Xon Example

In this example, it is assumed that the buffer size is 1500 and that some kind of error happened on the protocol stack.

```

+MIPSEND=1,"A344343ABC343438980BC...AB4" //Passing data to C24 socket 1
+MIPSEND:1,1200           //(Note: Size remaining in socket 1 accumulating buffer is 1200 bytes.)
+MIPSEND=1,"A344343ABC343438980BC...A23"
+MIPSEND:1,0               //(Note: No free space in buffer.)
+MIPXOFF: 1                //The C24 detects that the accumulating buffer on socket 1 has no free
space to accumulate data and data cannot be sent to the protocol stack.

```

From this point on, the terminal is not allowed to send data until it receives the +MIPXON command.

```

+MIPSEND=1,A344343ABC343438980BC...AB4//Terminal disregards the Xoff request of C24 and keeps
sending //(Note: The terminal does not stop.)

```

**ERROR 3**

```

+MIPXON: 1                //C24 pushed the data into the protocol stack and is able to handle
more sends from the terminal

```

## Error in Reopening a Valid Socket

```
AT+MIPCALL=1,"user","password"
```

```
OK
```

```
+MIPCALL:123.145.167.230
```

```
+MIOPEN=1,1222,"123.245.213.012",1234,0 //Opening socket 1 using TCP protocol, from port 1222,  
targeting 123.245.213.012 port 1234
```

```
OK
```

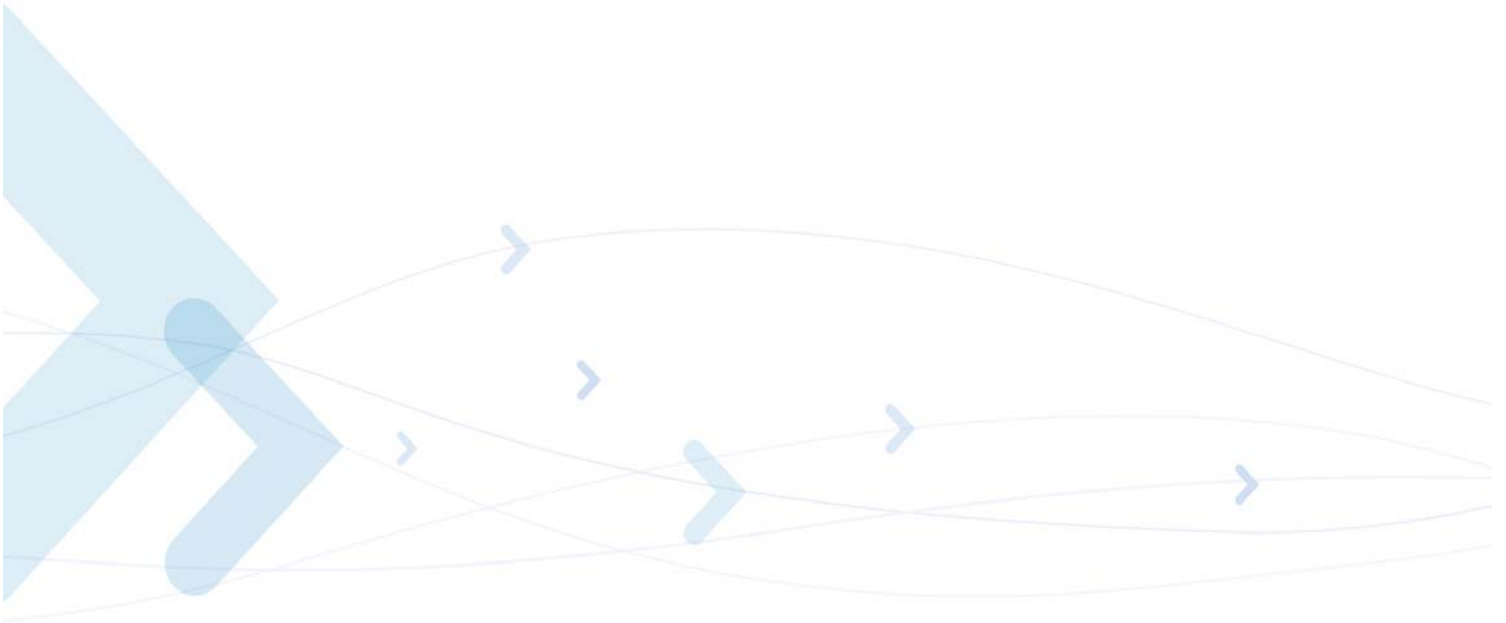
```
+MIOPEN:1,1
```

```
+MIOPEN? //Terminal checking the status of socket to be ready
```

```
+MIOPEN: 2 3 4
```

```
MIOPEN=1,12,123.245.213.012,234,0//Terminal tries to reopen socket 1
```

```
ERROR
```



## Audio

### Scenarios for Setting Up Handset Mode or Handsfree Mode

#### Handset Mode

<code>AT+MAPATH=1,1</code>	<code>//Set the input path through the microphone</code>
<code>AT+MAPATH=2,1,3</code>	<code>//Set voice and keypad through the earpiece speaker</code>
<code>AT+MAPATH=2,3,12</code>	<code>//Set alerts and rings to go through the transducer</code>
<code>AT+MAFEAT=6,0</code>	<code>//Disable echo cancellation and noise suppression</code>
<code>AT+MAFEAT=1,1</code>	<code>//Enable sidetone</code>

#### Handsfree Mode

<code>AT+MAPATH=1,1</code>	<code>//Set the input path through the microphone</code>
<code>AT+MAPATH=2,1,15</code>	<code>//Set all tones through the earpiece speaker</code>
<code>AT+MAFEAT=1,0</code>	<code>//Disable sidetone</code>
<code>AT+MAFEAT=6,1</code>	<code>//Enable echo cancellation and noise suppression</code>

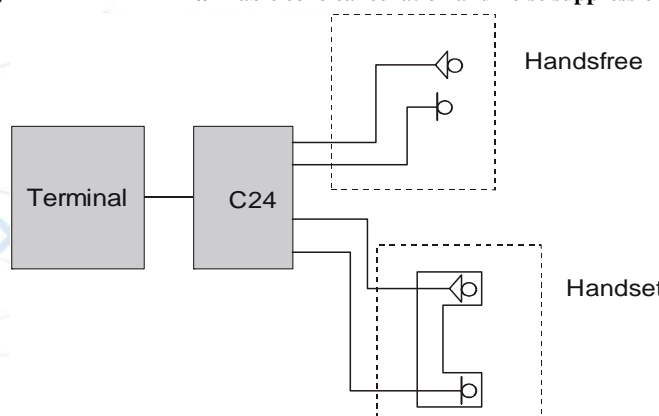


Figure 4-11: Handset or Handsfree Setup

## Firmware Update Over the Air (FOTA)

### FOTA Command for Non-Automatic Mode (Non-Transparent Mode)

// We would like to control all the FOTA steps, that the reason that we se the Non-Automatic mode.

AT+MFOTACNFG=0

// Enable FOTA indications

AT+MFOTAIND=1

+MFOTAREQ: 1

// Request to begin DM session (Bootstrap)

AT+MFOTARSP=0 OK

// Confirm DM session

+MFOTAIND: 10, 5

+MFOTAIND: 10, 10

+MFOTAREQ: 2

// Update package request

AT+MFOTARSP=0

// Confirm the update process

OK

+MFOTAIND: 10, 4

// Open applications indication

+MFOTAIND: 10, 5

// DM Session in progress

+MFOTAIND: 10, 7

// DM Session complete

+MFOTAIND: 16, 14

// Fetch descriptor file indication

+MFOTAIND: 16, 13, 0

// Descriptor progress bar indicate 0%

+MFOTAIND: 16, 13, 5

// Descriptor progress bar indicate 5%

+MFOTAIND: 15, 13, 5

// Update-package progress bar indicate 5%

+MFOTAIND: 15, 13, 44

// Update-package progress bar indicate 44%

+MFOTAIND: 15, 13, 83

// Update-package progress bar indicate 83%

+MFOTAIND: 15, 13, 100

// Update-package progress bar indicate 100%

+MFOTAREQ: 3

// Install package request

AT+MFOTARSP=0

// Confirm the install process

OK

+MFOTAIND: 40, 19

// Update has started indication

// During the Update process, the phone will be in flash-mode. The update process is supposed to take a few minutes.

## FOTA Command for Automatic Mode (Transparent Mode)

In automatic/transparent mode, FOTA process include SW Upgrade without any user interaction. In this case any +FOTREQ operational reports will not be sent toward DTE.

By setting AT+MFOTIND, the user can still get an indication on DTE.

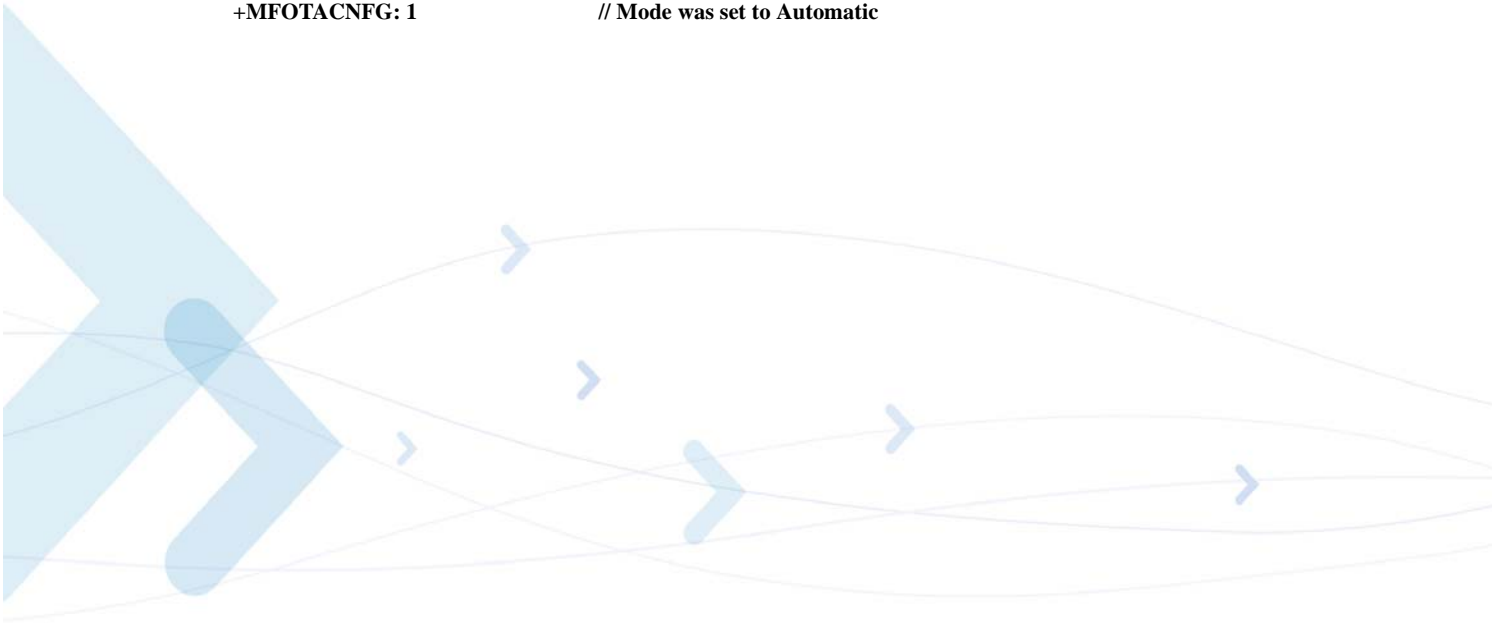
The default mode is the transparent mode.

**AT+MFOTACNFG=1**                      // Change the FOTA DM session mode to Automatic

**OK**

**AT+MFOTACNFG? ?**                      // Get the FOTA DM session mode

**+MFOTACNFG: 1**                      // Mode was set to Automatic



## Chapter 5: Tools

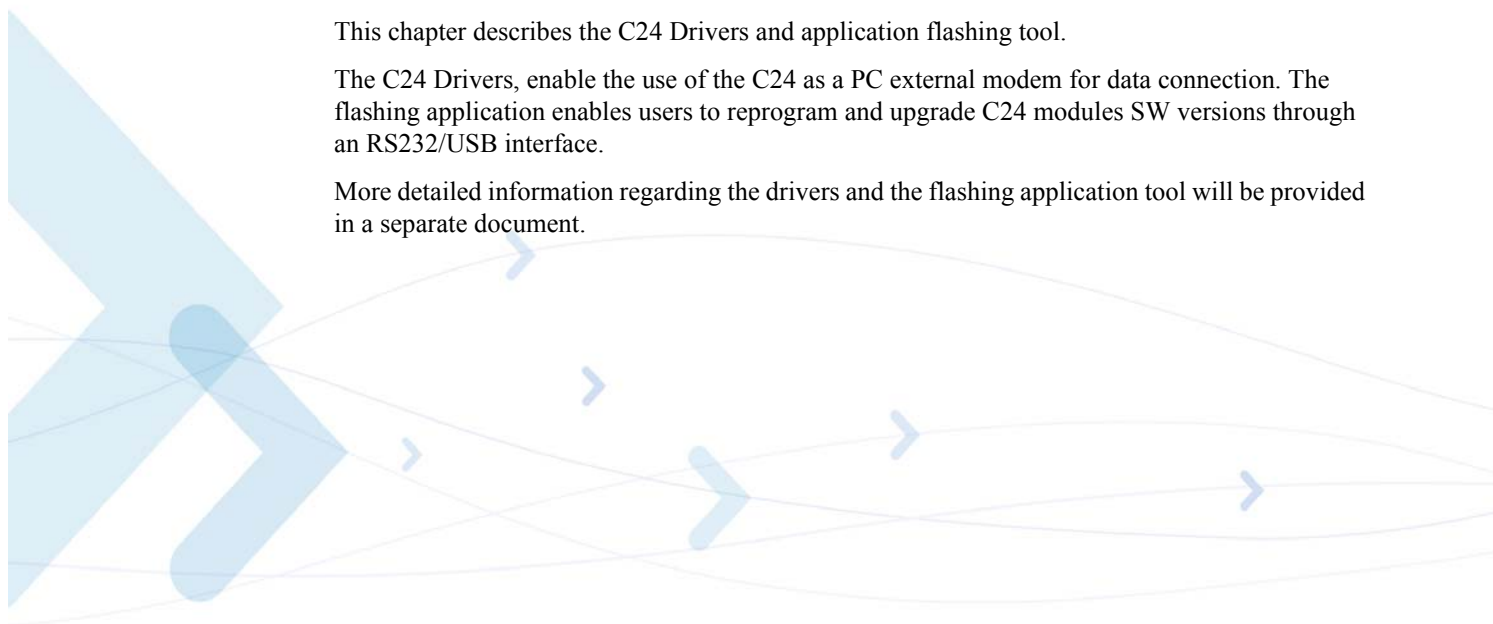
---

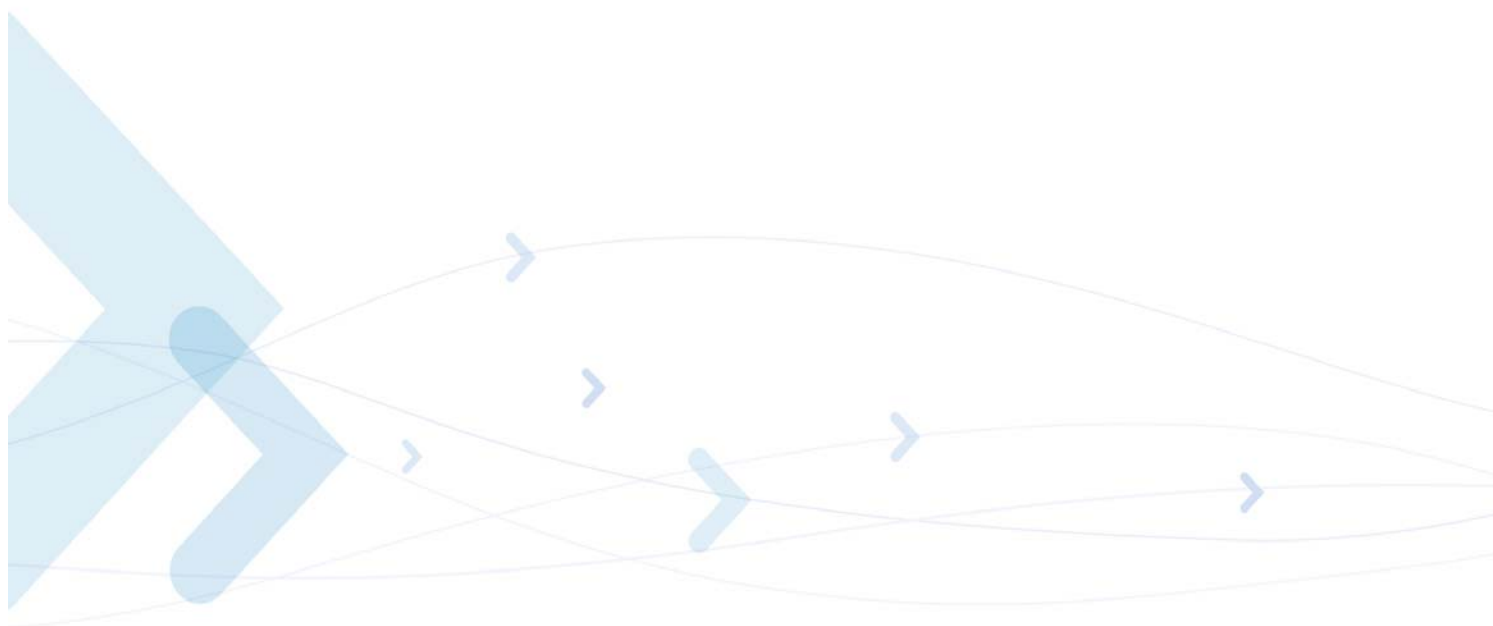
### Tools Overview

This chapter describes the C24 Drivers and application flashing tool.

The C24 Drivers, enable the use of the C24 as a PC external modem for data connection. The flashing application enables users to reprogram and upgrade C24 modules SW versions through an RS232/USB interface.

More detailed information regarding the drivers and the flashing application tool will be provided in a separate document.







## Appendix A: Reference Tables

This appendix contains the following sections:

- AT Commands Alphabetical Summary, below
- Character Set Table CS1: (GSM -> UCS-2), [Page A--14](#)
- Character Set Table CS2: (ASCII <-> UTF-8), [Page A--18](#)
- Character Set Table CS3: (UCS-2 <-> UTF-8), [Page A--19](#)
- Character Set Table CS6: (UCS-2 Full Table), [Page A--19](#)
- Character Set Table CS7: (ASCII table), [Page A--19](#)

**Note:** Character Set Table CS6: (UCS-2) is provided on CD due to its size.

### AT Commands Alphabetical Summary

The following table contains an alphabetical list of all the C24 AT commands.

**Table A-1: AT Commands (Alphabetical)**

AT Command	Description	Page
\$	This command displays a list of all the AT commands supported by the C24.	<a href="#">Page 3-3-8</a>
?	This command displays the most recently updated value stored in the S-register.	<a href="#">Page 3-3-218</a>
\S	This command displays the status of selected commands and S-registers.	<a href="#">Page 3-3-218</a>
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	<a href="#">Page 3-3-132</a>
&D	This command determines how the C24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	<a href="#">Page 3-3-134</a>
&F	This command restores the factory default configuration profile.	<a href="#">Page 3-3-219</a>
&K	This command configures the flow control.	<a href="#">Page 3-3-139</a>
&V	This command displays the current active configuration and stored user profiles.	<a href="#">Page 3-3-221</a>
&W	This command stores the current active configuration to user profile 0 or 1.	<a href="#">Page 3-3-221</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>&amp;Y</b>	This command selects power-up configuration to user's profile.	<a href="#">Page 3-3-223</a>
<b>+CAD</b>	This command queries the analog or digital service.	<a href="#">Page 3-3-275</a>
<b>+CALM</b>	This command handles the selection of the C24's alert sound mode.	<a href="#">Page 3-3-314</a>
<b>+CBAUD</b>	This command sets the baud rate on the current UART.	<a href="#">Page 3-3-136</a>
<b>+CBC</b>	This command queries the battery charger connection.	<a href="#">Page 3-3-135</a>
<b>+CBIP</b>	This command is used to display the base station's temporary IP address. The value displayed is in standard IP address format.	<a href="#">Page 3-3-281</a>
<b>+CCLK</b>	This command reads/sets the C24's current date and time settings.	<a href="#">Page 3-3-125</a>
<b>+CCWA</b>	This command controls the Call Waiting supplementary service, including settings and querying of the network by the C24.	<a href="#">Page 3-3-30</a>
<b>+CDR</b>	This command controls whether the extended-format +CDR: intermediate result code is transmitted by the MT2.	<a href="#">Page 3-3-276</a>
<b>+CDS</b>	This unsolicited response is sent to the TE upon receipt of a new SM.	<a href="#">Page 3-3-67</a>
<b>+CDS</b>	This command controls the V.42bis data compression function on the Um interface.	<a href="#">Page 3-3-277</a>
<b>+CDV</b>	This command dials voice calls.	<a href="#">Page 3-3-20</a>
<b>+CEER</b>	This command returns an extended error report containing one or more lines of information text, determined by the manufacturer, providing the reasons for the call-clearing errors.	<a href="#">Page 3-3-254</a>
<b>+CFG</b>	This command is used to set configuration string.	<a href="#">Page 3-3-283</a>
<b>+CFSN</b>	This command displays the factory serial number.	<a href="#">Page 3-3-7</a>
<b>+CFUN</b>	This command shuts down the phone functionality.	<a href="#">Page 3-3-141</a>
<b>+CGMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-3-1</a>
<b>+CGMM</b>	This command displays the model identification.	<a href="#">Page 3-3-2</a>
<b>+CGMR</b>	This command displays the revision identification.	<a href="#">Page 3-3-3</a>
<b>+CGSN</b>	This command displays the product serial number identification in decimal format.	<a href="#">Page 3-3-3</a>
<b>+CHV</b>	This command hangs-up a voice call.	<a href="#">Page 3-3-20</a>
<b>+CIEV</b>	An unsolicited indication regarding various phone indications that is sent to the DTE when the <ind> parameter of the +CMER command is set to 1.	<a href="#">Page 3-3-98</a>
<b>+CIMI</b>	This command displays the International Mobile Subscriber Identity number.	<a href="#">Page 3-3-7</a>
<b>+CIND</b>	This command is used to query the status of various ME indicators.	<a href="#">Page 3-3-101</a>
<b>+CLAC</b>	This command displays a list of all the AT commands supported by the C24.	<a href="#">Page 3-3-9</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+CLAN</b>	This command handles the selection of language in the ME.	<a href="#">Page 3-3-96</a>
<b>+CLCC</b>	This command displays a list of all current C24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	<a href="#">Page 3-3-39</a>
<b>+CLCK</b>	This command locks, unlocks or interrogates a C24 or a network facility <fac>.	<a href="#">Page 3-3-111</a>
<b>+CLIP</b>	This command controls the Calling Line Identity (CLI) presentation to the terminal when there is an incoming call.	<a href="#">Page 3-3-28</a>
<b>+CLIR</b>	This command enables/disables the sending of caller ID information to the called party, for an outgoing call.	<a href="#">Page 3-3-36</a>
<b>+CLVL</b>	This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the C24.	<a href="#">Page 3-3-302</a>
<b>+CMEE</b>	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the C24.	<a href="#">Page 3-3-250</a>
<b>+CMER</b>	Mobile Equipment Event Reporting.	<a href="#">Page 3-3-97</a>
<b>+CMGD</b>	This command deletes messages from the C24 memory.	<a href="#">Page 3-3-81</a>
<b>+CMGF</b>	This command handles the selection of message formats.	<a href="#">Page 3-3-57</a>
<b>+CMGL</b>	This command displays a list of SMS messages stored in the C24 memory.	<a href="#">Page 3-3-68</a>
<b>+CMGR</b>	This command reads selected SMS messages from the C24 memory.	<a href="#">Page 3-3-73</a>
<b>+CMGS</b>	This command sends an SM from the C24 to the network.	<a href="#">Page 3-3-82</a>
<b>+CMGW</b>	This command writes and saves messages in the C24 memory.	<a href="#">Page 3-3-78</a>
<b>+CMIP</b>	This command is used to display the mobile station's temporary IP address. The value displayed is in standard IP address format.	<a href="#">Page 3-3-280</a>
<b>+CMSS</b>	This command selects and sends pre-stored messages from the message storage.	<a href="#">Page 3-3-79</a>
<b>+CMT</b>	This unsolicited message forwards the SMS upon its arrival.	<a href="#">Page 3-3-66</a>
<b>+CMTI</b>	This unsolicited message, including the SMS message index, is sent upon the arrival of an SMS message.	<a href="#">Page 3-3-64</a>
<b>+CMUT</b>	This command mutes/unmutes the currently active microphone path by overriding the current mute state.	<a href="#">Page 3-3-303</a>
<b>+CMUX</b>	This command Used to set the maximum number of multiplex options for the forward and reverse links for MDR (HSPD) calls.	<a href="#">Page 3-3-282</a>
<b>+CNMA</b>	This command acknowledges the receipt of a +CMT response.	<a href="#">Page 3-3-66</a>
<b>+CNMI</b>	This command sends an unsolicited indication when a new SMS message is received by the C24.	<a href="#">Page 3-3-62</a>
<b>+COLP</b>	This command gets and changes the current setting of the Calling Line Presentation.	<a href="#">Page 3-3-23</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+CPAS</b>	This command displays the current activity status of the C24, for example, call in progress, or ringing.	<a href="#">Page 3-3-38</a>
<b>+CPBF</b>	This command searches the currently active phone book for a particular entry, by name.	<a href="#">Page 3-3-121</a>
<b>+CPBR</b>	This command recalls phone book entries from a specific entry number, or from a range of entries.	<a href="#">Page 3-3-120</a>
<b>+CPBS</b>	This command handles the selection of the memory to be used for reading and writing entries in C24s that contain more than one phone book memory.	<a href="#">Page 3-3-118</a>
<b>+CPBW</b>	This command stores a new entry in the phone book, or deletes an existing entry from the phone book.	<a href="#">Page 3-3-122</a>
<b>+CPIN</b>	This command unlocks the R-UIM card when the proper R-UIM PIN is provided and unblocks the R-UIM card when the proper R-UIM PUK is provided.	<a href="#">Page 3-3-104</a>
<b>+CPMS</b>	This command handles the selection of the preferred storage area for messages.	<a href="#">Page 3-3-54</a>
<b>+CPRL1</b>	This command set/get the PRL header parameters.	<a href="#">Page 3-3-241</a>
<b>+CPRL2</b>	This command enables the user to control the PRL acquisition table.	<a href="#">Page 3-3-243</a>
<b>+CPRL3</b>	This command enables the user to control the PRL System table.	<a href="#">Page 3-3-246</a>
<b>+CPRL4</b>	This command uploads an entire PRL file.	<a href="#">Page 3-3-249</a>
<b>+CPWD</b>	This command sets a new password for the facility lock.	<a href="#">Page 3-3-109</a>
<b>+CQD</b>	This command sets the timer value that specifies the period of inactivity before a Data call is released.	<a href="#">Page 3-3-280</a>
<b>+CRC</b>	This command controls whether to present the extended format of the incoming call indication.	<a href="#">Page 3-3-20</a>
<b>+CREG</b>	This command enables/disables the network status registration unsolicited result code.	<a href="#">Page 3-3-88</a>
<b>+CRING</b>	This unsolicited event indicates the type of incoming call.	<a href="#">Page 3-3-20</a>
<b>+CRM</b>	This command enables set the protocol on the Rm interface.	<a href="#">Page 3-3-279</a>
<b>+CRSL</b>	This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the C24.	<a href="#">Page 3-3-301</a>
<b>+CRTT</b>	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	<a href="#">Page 3-3-317</a>
<b>+CSCS</b>	This command selects the C24 character set.	<a href="#">Page 3-3-5</a>
<b>+CSDH</b>	This command shows the Text Mode parameters.	<a href="#">Page 3-3-58</a>
<b>+CSMP</b>	This command sets the Text Module parameters.	<a href="#">Page 3-3-60</a>
<b>+CSMS</b>	This command handles the selection of the SMS message service type.	<a href="#">Page 3-3-53</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+CSO</b>	This command specifies the preferred service to be requested for the next originated packet call.	<a href="#">Page 3-3-24</a>
<b>+CSQ</b>	This command displays the signal strength received by the C24.	<a href="#">Page 3-3-89</a>
<b>+CSVM</b>	This command handles the selection of the number to the voice mail server.	<a href="#">Page 3-3-124</a>
<b>+CTA</b>	This command is used to Set/Read/Test the Um packet data inactivity timer.	<a href="#">Page 3-3-274</a>
<b>+CXT</b>	The command is used for cellular extension.	<a href="#">Page 3-3-283</a>
<b>+DR</b>	This command controls whether the extended-format +DR: intermediate result code is transmitted from the IWF over the Um interface.	<a href="#">Page 3-3-292</a>
<b>+DS</b>	This command controls the V.42 bis data compression function on the PSTN link if provided in the IWF.	<a href="#">Page 3-3-291</a>
<b>+EFCS</b>	This command controls the use of the 32-bit frame check sequence option in V.42 on the PSTN link (if present in the IWF).	<a href="#">Page 3-3-294</a>
<b>+EPIN</b>	This AT command will be used to verify the PIN2 when the proper R-UIM PIN2 password has been provided.	<a href="#">Page 3-3-107</a>
<b>+ER</b>	This command controls whether the extended-format +ER: intermediate result code is transmitted from the IWF over the Um interface.	<a href="#">Page 3-3-290</a>
<b>+ES</b>	This command controls the manner of operation of the V.42 protocol on the PSTN link (if present in the IWF).	<a href="#">Page 3-3-289</a>
<b>+ESR</b>	This command controls the use of the selective repeat (SREJ) option in V.42 on the PSTN link (if present in the IWF).	<a href="#">Page 3-3-288</a>
<b>+ETBM</b>	This extended command controls the handling of data remaining in IWF buffers upon service termination.	<a href="#">Page 3-3-286</a>
<b>+FCLASS</b>	This command places the terminal in particular mode of operation (data, fax, voice).	<a href="#">Page 3-3-128</a>
<b>+FMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-3-1</a>
<b>+FMM</b>	This command displays the model identification.	<a href="#">Page 3-3-2</a>
<b>+FMR</b>	This command displays the revision identification.	<a href="#">Page 3-3-3</a>
<b>+FTPCDUP</b>	This command causes the C24 to request the remote FTP server to change the working directory up.	<a href="#">Page 3-3-204</a>
<b>+FTPCLOSE</b>	This command causes C24 to close FTP connection, when no data transfer occurred at that same time.	<a href="#">Page 3-3-194</a>
<b>+FTPCWD</b>	This command causes the C24 to request the remote FTP server to change the working directory in accordance to a given name.	<a href="#">Page 3-3-200</a>
<b>+FTPDEL</b>	This command causes the C24 to request the remote FTP server to delete a file, in accordance to a given name.	<a href="#">Page 3-3-205</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+FTPINFO</b>	This command causes the C24 to enable or disable FTP unsolicited indication to the user.	<a href="#">Page 3-3-195</a>
<b>+FTPLIST</b>	This command causes the C24 to request the remote FTP server to send a list, in accordance to a given parameter.	<a href="#">Page 3-3-206</a>
<b>+FTPMKD</b>	This command causes the C24 to request the remote FTP server to create a new directory in accordance to a given name.	<a href="#">Page 3-3-201</a>
<b>+FTPNOOP</b>	This command causes the C24 to request the remote FTP server to do nothing.	<a href="#">Page 3-3-199</a>
<b>+FTPOPEN</b>	This command causes C24 to open a FTP connection with a remote FTP server, based on given parameters.	<a href="#">Page 3-3-192</a>
<b>+FTPPWD</b>	This command causes C24 to request the remote FTP server to return the working directory name.	<a href="#">Page 3-3-204</a>
<b>+FTPREN</b>	This command causes the C24 to request the remote FTP server to rename a file, in accordance to given parameters.	<a href="#">Page 3-3-210</a>
<b>+FTPRETR</b>	This command causes the C24 to request the remote FTP server to send a file to the C24.	<a href="#">Page 3-3-209</a>
<b>+FTPRMD</b>	This command causes the C24 to request the remote FTP server to remove a directory in accordance to a given name.	<a href="#">Page 3-3-202</a>
<b>+FTPSTAT</b>	This command causes the C24 to request the remote FTP server to send status, in accordance to a given parameter.	<a href="#">Page 3-3-197</a>
<b>+FTPSTOR</b>	This command causes the C24 to request the remote FTP server to store a file, sent by the C24.	<a href="#">Page 3-3-208</a>
<b>+FTPSYST</b>	This command causes the C24 to request the remote FTP server to send the operating system type.	<a href="#">Page 3-3-199</a>
<b>+FTPTYPE</b>	This command represents the file supported by the C24.	<a href="#">Page 3-3-207</a>
<b>+GCAP</b>	This command displays the overall capabilities of the C24.	<a href="#">Page 3-3-132</a>
<b>+GMI</b>	This command displays manufacturer identification.	<a href="#">Page 3-3-1</a>
<b>+GMM</b>	This command displays the model identification.	<a href="#">Page 3-3-2</a>
<b>+GMR</b>	This command displays the revision identification.	<a href="#">Page 3-3-3</a>
<b>+GOI</b>	This command transmits information text, determined by the manufacturer.	<a href="#">Page 3-3-297</a>
<b>+GSN</b>	This command displays the product serial number identification in Hex format.	<a href="#">Page 3-3-3</a>
<b>+ICF</b>	This command determines the Character Framing.	<a href="#">Page 3-3-380</a>
<b>+IFC</b>	This command controls the operation of Local Flow Control between the terminal and the C24.	<a href="#">Page 3-3-381</a>
<b>+ILRR</b>	This extended-format numeric parameter controls whether the extended-format +ILRR:<rate> information text is transmitted from the MT2 to the TE2.	<a href="#">Page 3-3-380</a>



**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+IPR</b>	This command is responsible for setting and saving the request baud rate per UART	<a href="#">Page 3-3-138</a>
<b>+MADIGITAL</b>	This command switches between analog and digital audio modes.	<a href="#">Page 3-3-313</a>
<b>+MAFEAT</b>	This command controls the various algorithm features, such as sidetone, echo cancel and noise suppress.	<a href="#">Page 3-3-312</a>
<b>+MAIF</b>	This command allows the user to manage supplementary services by sending an air interface Flash.	<a href="#">Page 3-3-28</a>
<b>+MAMOD</b>	This command selects the audio mode for echo cancellation.	<a href="#">Page 3-3-321</a>
<b>+MAMUT</b>	This command controls the muting/unmuting of all input paths (MIC, HDST_MIC, DIGITAL_RX).	<a href="#">Page 3-3-311</a>
<b>+MAPATH</b>	This command sets/requests the active input accessory, and the output accessory for each feature.	<a href="#">Page 3-3-306</a>
<b>+MARD</b>	This command enables and disables the auto-redial capability of the C24.	<a href="#">Page 3-3-18</a>
<b>+MARS</b>	This command enables the C24 to report when auto redial starts or ends, when enabled.	<a href="#">Page 3-3-18</a>
<b>+MAVOL</b>	This command determines a volume setting for a particular feature in a particular accessory.	<a href="#">Page 3-3-308</a>
<b>+MBAND</b>	This command selects Preferred Band.	<a href="#">Page 3-3-94</a>
<b>+MCST</b>	This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.	<a href="#">Page 3-3-42</a>
<b>+MDC</b>	This AT command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	<a href="#">Page 3-3-24</a>
<b>+MDISP</b>	This command is used to display characters that the network sends to the module.	<a href="#">Page 3-3-92</a>
<b>+MDMIC</b>	This command enables/disables the setting of microphone gain values by +MMICG in digital audio mode.	<a href="#">Page 3-3-315</a>
<b>+MDORMANT</b>	This command enable/disable the dormant indication unsolicited report.	<a href="#">Page 3-3-93</a>
<b>+MECALL</b>	This unsolicited report sends indication of an emergency call to the terminal.	<a href="#">Page 3-3-44</a>
<b>+MFIC</b>	This command instructs the C24 to query or set Filtering Incoming Calls parameters.	<a href="#">Page 3-3-25</a>
<b>+MFOC</b>	This command instructs the C24 to query or set Filtering Outgoing Calls parameters.	<a href="#">Page 3-3-27</a>
<b>+MFOTAABORT</b>	Aborts the DM session.	<a href="#">Page 3-3-327</a>
<b>+MFOTACNFG</b>	This command enables setting the DM session as Automatic/Non-Automatic (i.e. Transparent/Non-Transparent).	<a href="#">Page 3-3-323</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+MFOTAIND</b>	This command sends Unsolicited FOTA indications toward DTE.	<a href="#">Page 3-3-328</a>
<b>+MFOTAINSTL</b>	Installs the updated package.	<a href="#">Page 3-3-327</a>
<b>+MFOTAREQ</b>	This command sends FOTA requests toward DTE.	<a href="#">Page 3-3-324</a>
<b>+MFOTARLBCK</b>	This command causes the module to install the reverse firmware version.	<a href="#">Page 3-3-329</a>
<b>+MFOTARSP</b>	This command is used to send response to +MFOTAREQ reports.	<a href="#">Page 3-3-325</a>
<b>+MFOTASTART</b>	This command enable the DTE originates DM session and FOTA download & install.	<a href="#">Page 3-3-330</a>
<b>+MGPSLOC</b>	This command displays solicited/unsolicited location message to the terminal.	<a href="#">Page 3-3-340</a>
<b>+MGPSLUPD</b>	This command set the interval of almanac/ephemeris data downloads.	<a href="#">Page 3-3-341</a>
<b>+MGPSMODE</b>	This command supports the GPS operation mode.	<a href="#">Page 3-3-339</a>
<b>+MGPSMPCIP</b>	This command set the IP address and port for the MPC server.	<a href="#">Page 3-3-344</a>
<b>+MGPSPPDEIP</b>	This command set the IP address and port for the primary PDE server.	<a href="#">Page 3-3-342</a>
<b>+MGPSPROT</b>	This command sets the GPS protocol.	<a href="#">Page 3-3-344</a>
<b>+MGPSQOS</b>	This command sets the GPS QoS parameters.	<a href="#">Page 3-3-345</a>
<b>+MGPSRES</b>	This command resets all location related parameters.	<a href="#">Page 3-3-345</a>
<b>+MGPSPPDEIP</b>	This command set the IP address and port for the secondary PDE server.	<a href="#">Page 3-3-343</a>
<b>+MIOC</b>	This command defines the C24 8 GPIO pins data value.	<a href="#">Page 3-3-143</a>
<b>+MIOD</b>	This command defines the C24 8 GPIO pins configuration.	<a href="#">Page 3-3-146</a>
<b>+MIPCALL</b>	This command creates a wireless PPP connection with the GGSN or CSD service provider and returns a valid dynamic IP for the C24.	<a href="#">Page 3-3-153</a>
<b>+MIPCFF</b>	This command allows configuring the incoming TCP connection filtering feature parameters, such as list of allowed IP addresses or disabling/enabling the filtering.	<a href="#">Page 3-3-175</a>
<b>+MIPCLOSE</b>	This command causes the C24 module to free the socket accumulating buffer and disconnect the C24 from a remote side.	<a href="#">Page 3-3-156</a>
<b>+MIPCONF</b>	This command allows configuring of TCP stack parameters.	<a href="#">Page 3-3-165</a>
<b>+MIPCSC</b>	This AT command is used to configure the SSL feature behavior in case of non - fatal alerts.	<a href="#">Page 3-3-185</a>
<b>+MIPDATA</b>	This unsolicited event is sent to the terminal indicating a data comes from Network when C24 is in pseudo-command mode.	<a href="#">Page 3-3-184</a>
<b>+MIPFLUSH</b>	This command causes the C24 module to flush (delete) data accumulated in its accumulating buffers.	<a href="#">Page 3-3-161</a>



**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+MIPODM</b>	This command causes the C24 module to initialize a new socket in Online Data Mode and open a connection with a remote side.	<a href="#">Page 3-3-181</a>
<b>+MIPOPEN</b>	This command causes the C24 module to initialize a new socket and open a connection with a remote side.	<a href="#">Page 3-3-154</a>
<b>+MIPPUSH</b>	This command causes the C24 module to push the data accumulated in its accumulating buffers into the protocol stack.	<a href="#">Page 3-3-160</a>
<b>+MIPRTCP</b>	This unsolicited event is sent to the terminal when data is received from the TCP protocol stack.	<a href="#">Page 3-3-162</a>
<b>+MIPRUDP</b>	This unsolicited event is sent to the terminal when data is received from the UDP protocol stack.	<a href="#">Page 3-3-162</a>
<b>+MIPSEND</b>	This command causes the C24 to transmit the data that the terminal provides, using an existing protocol stack.	<a href="#">Page 3-3-159</a>
<b>+MIPSETS</b>	This command causes the C24 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.	<a href="#">Page 3-3-157</a>
<b>+MIPSSL</b>	This unsolicited event is sent to the terminal indicating an errors, warnings or alerts that occurred during SSL connection.	<a href="#">Page 3-3-179</a>
<b>+MIPSTAT</b>	This unsolicited event is sent to the terminal indicating a change in link status.	<a href="#">Page 3-3-163</a>
<b>+MIPXOFF</b>	This unsolicited event is sent to the terminal to stop sending data.	<a href="#">Page 3-3-164</a>
<b>+MIPXON</b>	This unsolicited event is sent to the terminal when the C24 has free memory in the accumulating buffer.	<a href="#">Page 3-3-164</a>
<b>+MMAD</b>	This command reads and monitors digital value from a specified ADC.	<a href="#">Page 3-3-148</a>
<b>+MMAR</b>	This command changes the status of an SMS message in the C24 memory from "REC UNREAD" to "REC READ".	<a href="#">Page 3-3-77</a>
<b>+MMGL</b>	This command displays a list of SMS messages stored in the C24 memory.	<a href="#">Page 3-3-68</a>
<b>+MMGR</b>	This command reads selected SMS messages from the C24 memory.	<a href="#">Page 3-3-73</a>
<b>+MMICG</b>	This command handles the selection of microphone gain values.	<a href="#">Page 3-3-315</a>
<b>+MMR</b>	This command perform master reset.	<a href="#">Page 3-3-99</a>
<b>+MMRR</b>	This unsolicited message is sent to the DTE by the C24 if a master reset occurs, and master reset events reporting is enabled.	<a href="#">Page 3-3-100</a>
<b>+MMRU</b>	This command provides limited access to the Elementary Files on the R-UIM.	<a href="#">Page 3-3-113</a>
<b>+MMUX</b>	This command is used to enable/disable the MUX multiplexing protocol stack.	<a href="#">Page 3-3-364</a>
<b>+MNAM</b>	This command gets or sets the NAM parameters (parameters 1-12 out of 35).	<a href="#">Page 3-3-231</a>
<b>+MNAM2</b>	This command gets or sets the NAM parameters (parameters 13-22 out of 35).	<a href="#">Page 3-3-233</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+MNAM3</b>	This command gets or sets the NAM parameters (parameters 23-35 out of 35).	<a href="#">Page 3-3-235</a>
<b>+MNMEA</b>	This commands routes the NMEA reports to UART2 or USB.	<a href="#">Page 3-3-346</a>
<b>+MODCI</b>	This command supports the client initiating of OMA-DM session.	<a href="#">Page 3-3-334</a>
<b>+MODDC</b>	This command Enable/Disable the OMA-DM DC update.	<a href="#">Page 3-3-331</a>
<b>+MODFUMO</b>	This command Enable/Disable the OMA-DM FUMO update.	<a href="#">Page 3-3-332</a>
<b>+MODIND</b>	This command displays the progress of the updates.	<a href="#">Page 3-3-335</a>
<b>+MODNI</b>	This command supports the NW initiating of OMA-DM session.	<a href="#">Page 3-3-335</a>
<b>+MODPRL</b>	This command Enable/Disable the OMA-DM PRL update.	<a href="#">Page 3-3-331</a>
<b>+MOTAIND</b>	This command displays the progress of updates.	<a href="#">Page 3-3-337</a>
<b>+MPESND</b>	Requests Pseudo Electronic Serial Number Identification in Decimal.	<a href="#">Page 3-3-4</a>
<b>+MPESNH</b>	Requests Pseudo Electronic Serial Number Identification in Hex.	<a href="#">Page 3-3-5</a>
<b>+MPIN</b>	This command enables the accessory application to unlock the phone when the appropriate unlock code has been provided.	<a href="#">Page 3-3-103</a>
<b>+MPING</b>	This command will allow verifying IP connectivity to another remote machine (computer) by sending one or more Internet Control Message Protocol (ICMP) Echo Request messages.	<a href="#">Page 3-3-167</a>
<b>+MPINGSTAT</b>	This is the unsolicited response that the C24 sends to the terminal to inform of ping execution status update and provides summary statistics of ping request when ping request execution is completed.	<a href="#">Page 3-3-171</a>
<b>+MPREFMODE</b>	This command configures System Select setting.	<a href="#">Page 3-3-94</a>
<b>+MPRISUM</b>	This command return the PRI checksum.	<a href="#">Page 3-3-250</a>
<b>+MREFLASH</b>	Enter to Re-Flash Mode.	<a href="#">Page 3-3-257</a>
<b>+MRST</b>	This command enables customer software to perform a hard reset to the C24 unit.	<a href="#">Page 3-3-143</a>
<b>+MS</b>	This command controls the manner of operation of the modulation capabilities in the IWF.	<a href="#">Page 3-3-286</a>
<b>+MSCTS</b>	This command defines the behavior of the CTS line when the C24 is in normal mode (not Sleep mode).	<a href="#">Page 3-3-229</a>
<b>+MSDNS</b>	This command set/read DNS IP address.	<a href="#">Page 3-3-174</a>
<b>+MSPC</b>	This unsolicited message displays an error report in case the network set incorrect password for more times than permitted.	<a href="#">Page 3-3-257</a>
<b>+MSSI</b>	This command enables/disables the unsolicited report for signal strength value.	<a href="#">Page 3-3-90</a>
<b>+MTIME</b>	This command returns 3 types of accumulated internal timers as reported by the module.	<a href="#">Page 3-3-385</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>+MTTY</b>	This AT command is used to enable or disable TTY (Tele Typewriter) support in C24 modules.	<a href="#">Page 3-3-383</a>
<b>+MV18R</b>	This command controls whether the extended-format +MV18R: result code is transmitted from the IWF to the mobile station.	<a href="#">Page 3-3-285</a>
<b>+MV18S</b>	This command controls the manner of operation of the V.18 capabilities (if present in the IWF).	<a href="#">Page 3-3-284</a>
<b>+MVPRI</b>	This command sets the voice privacy.	<a href="#">Page 3-3-44</a>
<b>+NETPAR</b>	This command displays information regarding the active, candidate, and neighbor cell.	<a href="#">Page 3-3-91</a>
<b>+SNAM</b>	This command Selects/reads the current active NAM to which the NAM data will be written/retrieved using AT+MNAME [x].	<a href="#">Page 3-3-238</a>
<b>+TPIN</b>	This command returns the number of remaining attempts of entering the PIN and PUK for the R-UIM card in use.	<a href="#">Page 3-3-108</a>
<b>+UMID</b>	This command returns the User Identification Module Identifier (UMID) of the R-UIM.	<a href="#">Page 3-3-5</a>
<b>+VTD</b>	This command handles the selection of tone duration.	<a href="#">Page 3-3-319</a>
<b>+VTS</b>	This command transmits a string of DTMF tones when a voice call is active.	<a href="#">Page 3-3-320</a>
<b>\$PMOTG</b>	This command Executes NMEA output message commands.	<a href="#">Page 3-3-356</a>
<b>\$QCCAV</b>	This command answers an incoming voice call.	<a href="#">Page 3-3-19</a>
<b>\$QCCLR</b>	This command clears the mobile error log.	<a href="#">Page 3-3-380</a>
<b>\$QCDMR</b>	This command sets the DM baud rate (for use with Diagnostic Monitor only such as QXDM).	<a href="#">Page 3-3-296</a>
<b>\$QCMDR</b>	This command sets the Medium Data Rate (MDR) (also known as HSPD) setting.	<a href="#">Page 3-3-295</a>
<b>\$QCMIP</b>	This command enables/disables Mobile IP functionality in the module.	<a href="#">Page 3-3-272</a>
<b>\$QCMIPPEP</b>	This command enables/disables the currently active profile.	<a href="#">Page 3-3-265</a>
<b>\$QCMIPGETP</b>	This command returns the information to a specific profile.	<a href="#">Page 3-3-266</a>
<b>\$QCMIPHA</b>	This command sets the HA IP for the currently active profile.	<a href="#">Page 3-3-260</a>
<b>\$QCMIPMASPI</b>	This command sets the MN-AAA SPIs for the currently active profile.	<a href="#">Page 3-3-264</a>
<b>\$QCMIPMASS</b>	This command sets the MN-AAA shared secret for the currently active profile.	<a href="#">Page 3-3-262</a>
<b>\$QCMIPMHSPi</b>	This command sets the MN-HA SPIs for the currently active profile.	<a href="#">Page 3-3-263</a>
<b>\$QCMIPMHSS</b>	This command sets the MN-HA shared secret for the currently active profile.	<a href="#">Page 3-3-261</a>
<b>\$QCMIPNAI</b>	This command sets the NAI for the currently active profile.	<a href="#">Page 3-3-258</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>\$QCMIPP</b>	This command selects MIP user profile to be active.	<a href="#">Page 3-3-271</a>
<b>\$QCMIPPHA</b>	This command sets the primary HA IP for the currently active profile.	<a href="#">Page 3-3-259</a>
<b>\$QCMIPRT</b>	This command sets the reverse tunneling preference for the currently active profile.	<a href="#">Page 3-3-264</a>
<b>\$QCMIPSHA</b>	This command sets the secondary HA IP for the currently active profile.	<a href="#">Page 3-3-260</a>
<b>\$QCMIPT</b>	This command enables/disables the use of rfc2002bis authentication.	<a href="#">Page 3-3-270</a>
<b>\$QCPREV</b>	This command returns the protocol revision in use.	<a href="#">Page 3-3-188</a>
<b>\$QCQNC</b>	This command enables/disables Quick Net Connect (QNC).	<a href="#">Page 3-3-267</a>
<b>\$QCSCRM</b>	This command enables/disables the mobile from SCRM'ing (SCRM, Supplemental Channel Request Message).	<a href="#">Page 3-3-294</a>
<b>\$QCSO</b>	This command sets the Data Service Option number to non-volatile memory.	<a href="#">Page 3-3-269</a>
<b>\$QCTRL</b>	This command enables/disables IS2000 devices from throttling the R-SCH.	<a href="#">Page 3-3-268</a>
<b>\$QCVAD</b>	This command responds to a page message that has a voice service option with a page response that has a data service option.	<a href="#">Page 3-3-273</a>
<b>\$SPCURRENTLOCK</b>	This command reads the current device lock code.	<a href="#">Page 3-3-389</a>
<b>\$SPERI</b>	This command reports the current enhanced roaming indicator.	<a href="#">Page 3-3-390</a>
<b>\$SPFWREV</b>	This command reads the current Firmware version.	<a href="#">Page 3-3-387</a>
<b>\$SPGETLOCATION</b>	This command returns the device current location.	<a href="#">Page 3-3-393</a>
<b>\$SPLOCATION</b>	This command enables/disables the GPS service.	<a href="#">Page 3-3-393</a>
<b>\$SPMDN</b>	This command reads the 10 digits phone number.	<a href="#">Page 3-3-386</a>
<b>\$SPMIPERR</b>	This command retrieves the last MIP error from the device.	<a href="#">Page 3-3-387</a>
<b>\$SPMSID</b>	This command reads the 10 digits phone number.	<a href="#">Page 3-3-386</a>
<b>\$SPNMEA</b>	This command enables or disables the NMEA stream.	<a href="#">Page 3-3-394</a>
<b>\$SPPRL</b>	This command reads the current PRL number from the device.	<a href="#">Page 3-3-388</a>
<b>\$SPRESET</b>	This command reset the module (power off than power on).	<a href="#">Page 3-3-395</a>
<b>\$SPRMGUARD</b>	This command enables/disables the roam guard unsolicited report.	<a href="#">Page 3-3-391</a>
<b>\$SPROAM</b>	This command selects the Roaming Preferences.	<a href="#">Page 3-3-389</a>
<b>\$SPSERVICE</b>	This command reads the service to which the modem will attempt to connect.	<a href="#">Page 3-3-388</a>
<b>\$SPSIGDBM</b>	This command reads the current Receive Signal Strength Indicator.	<a href="#">Page 3-3-389</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>\$SPSPC</b>	This command unlocks the SPC code, to enable access to protected areas of the device.	<a href="#">Page 3-3-387</a>
<b>A</b>	This command answers an incoming call, placing the C24 into the appropriate mode, as indicated by the RING message.	<a href="#">Page 3-3-17</a>
<b>A/</b>	This command repeats the last command entered on the terminal.	<a href="#">Page 3-3-104</a>
<b>AT</b>	This command checks the AT communication and only returns OK.	<a href="#">Page 3-3-104</a>
<b>D</b>	This command places a voice call on the current network, when issued from an accessory device.	<a href="#">Page 3-3-12</a>
<b>D&gt;</b>	This command places a voice/fax/data call on the current network by dialing directly from the C24 phone book.	<a href="#">Page 3-3-13</a>
<b>DL</b>	This command places a voice call to the last number dialed.	<a href="#">Page 3-3-15</a>
<b>E</b>	This command defines whether the C24 echoes the characters received from the user, (whether input characters are echoed to output).	<a href="#">Page 3-3-214</a>
<b>GGA</b>	This command displays the Global Positioning System Fixed Data.	<a href="#">Page 3-3-347</a>
<b>GLL</b>	This command displays the Geographic Position - Latitude/Longitude.	<a href="#">Page 3-3-349</a>
<b>GSA</b>	This command displays the GNSS DOP and Active Satellites.	<a href="#">Page 3-3-350</a>
<b>GSV</b>	This command displays the GNSS Satellites in View.	<a href="#">Page 3-3-352</a>
<b>H</b>	This command hangs up, or terminates a data call.	<a href="#">Page 3-3-16</a>
<b>I</b>	This command displays various C24 information items.	<a href="#">Page 3-3-7</a>
<b>O</b>	This command returns the C24 from the Command mode to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	<a href="#">Page 3-3-22</a>
<b>Q</b>	This command determines whether to output/suppress the result codes.	<a href="#">Page 3-3-213</a>
<b>RING</b>	This unsolicited event is received when an incoming call (voice, data or fax) is indicated by the cellular network.	<a href="#">Page 3-3-20</a>
<b>RMC</b>	This command displays the Recommended Minimum Specific GNSS Data.	<a href="#">Page 3-3-353</a>
<b>S100</b>	This command is a terminal minimum time limit for entering sleep mode.	<a href="#">Page 3-3-228</a>
<b>S102</b>	This S-register sets the value of the delay before sending the data to the terminal.	<a href="#">Page 3-3-227</a>
<b>S2</b>	This command handles the selection of the escape characters.	<a href="#">Page 3-3-218</a>
<b>S24</b>	This command activates/disables the Sleep mode.	<a href="#">Page 3-3-226</a>
<b>S94</b>	This S-parameter represents the Boolean status, On/Off, of the sidetone feature.	<a href="#">Page 3-3-304</a>

**Table A-1: AT Commands (Alphabetical) (Cont.)**

AT Command	Description	Page
<b>S96</b>	This S-parameter represents the Boolean status, On/Off, of the echo cancelling feature in the handsfree.	<a href="#">Page 3-3-305</a>
<b>S97</b>	This command indicates whether an antenna is physically connected to the C24 RF connector.	<a href="#">Page 3-3-142</a>
<b>Sn</b>	This command reads/writes values of the S-registers.	<a href="#">Page 3-3-216</a>
<b>V</b>	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	<a href="#">Page 3-3-212</a>
<b>VTG</b>	This command displays the Course Over Ground and Ground Speed.	<a href="#">Page 3-3-354</a>
<b>X</b>	This command defines the data adaptor response set, and the CONNECT result code format.	<a href="#">Page 3-3-215</a>
<b>Z</b>	This command resets the default configuration.	<a href="#">Page 3-3-220</a>
<b>ZDA</b>	This command displays the Time and Date.	<a href="#">Page 3-3-355</a>

## Character Set Table CS1: (GSM -> UCS-2)

The following table shows the conversion between the GSM and UCS-2 character sets.

Symbol	GSM	(GSM 03.38)
<b>UCS-2</b>	(ISO 10646-1)	@
<b>0x00</b>	0x0040	£
<b>0x01</b>	0x00A3	\$
<b>0x02</b>	0x0024	¥
<b>0x03</b>	0x00A5	è
<b>0x04</b>	0x00E8	é
<b>0x05</b>	0x00E9	ù
<b>0x06</b>	0x00F9	ì
<b>0x07</b>	0x00EC	ò
<b>0x08</b>	0x00F2	Ç
<b>0x09</b>	0x00C7	LF
<b>0x0A</b>	0x000A	Ø
<b>0x0B</b>	0x00D8	ø
<b>0x0C</b>	0x00F8	CR
<b>0x0D</b>	0x000D	Å

Symbol	GSM	(GSM 03.38)
0x0E	0x00C5	â
0x0F	0x00E5	Ä
0x10	0x0394	–
0x11	0x005F	Ö
0x12	0x03A6	Å
0x13	0x0393	Ë
0x14	0x039B	Û
0x15	0x03A9	Ð
0x16	0x03A0	Ø
0x17	0x03A8	Ó
0x18	0x03A3	È
0x19	0x0398	Î
0x1A	0x039E	Ì
0x1B	0x258A	Æ
0x1C	0x00C6	æ
0x1D	0x00E6	ß
0x1E	0x03B2	É
0x1F	0x00C9	SP
0x20	0x0020	!
0x21	0x0021	"
0x22	0x0022	#
0x23	0x0023	¤
0x24	0x00A4	%
0x25	0x0025	&
0x26	0x0026	'
0x27	0x0027	(
0x28	0x0028	)
0x29	0x0029	*
0x2A	0x002A	+
0x2B	0x002B	,
0x2C	0x002C	-
0x2D	0x002D	.
0x2E	0x002E	/



Symbol	GSM	(GSM 03.38)
0x2F	0x002F	0
0x30	0x0030	1
0x31	0x0031	2
0x32	0x0032	3
0x33	0x0033	4
0x34	0x0034	5
0x35	0x0035	6
0x36	0x0036	7
0x37	0x0037	8
0x38	0x0038	9
0x39	0x0039	:
0x3A	0x003A	;
0x3B	0x003B	<
0x3C	0x003C	=
0x3D	0x003D	>
0x3E	0x003E	?
0x3F	0x003F	i
0x40	0x00A1	A
0x41	0x0041	B
0x42	0x0042	C
0x43	0x0043	D
0x44	0x0044	E
0x45	0x0045	F
0x46	0x0046	G
0x47	0x0047	H
0x48	0x0048	I
0x49	0x0049	J
0x4A	0x004A	K
0x4B	0x004B	L
0x4C	0x004C	M
0x4D	0x004D	N
0x4E	0x004E	O
0x4F	0x004F	P



Symbol	GSM	(GSM 03.38)
0x50	0x0050	Q
0x51	0x0051	R
0x52	0x0052	S
0x53	0x0053	T
0x54	0x0054	U
0x55	0x0055	V
0x56	0x0056	W
0x57	0x0057	X
0x58	0x0058	Y
0x59	0x0059	Z
0x5A	0x005A	Ä
0x5B	0x00C4	Ö
0x5C	0x00D6	Ñ
0x5D	0x00D1	Ü
0x5E	0x00DC	§
0x5F	0x00A7	ı
0x60	0x00BF	a
0x61	0x0061	b
0x62	0x0062	c
0x63	0x0063	d
0x64	0x0064	e
0x65	0x0065	f
0x66	0x0066	g
0x67	0x0067	h
0x68	0x0068	i
0x69	0x0069	j
0x6A	0x006A	k
0x6B	0x006B	l
0x6C	0x006C	m
0x6D	0x006D	n
0x6E	0x006E	o
0x6F	0x006F	p
0x70	0x0070	q

Symbol	GSM	(GSM 03.38)
0x71	0x0071	r
0x72	0x0072	s
0x73	0x0073	t
0x74	0x0074	u
0x75	0x0075	v
0x76	0x0076	w
0x77	0x0077	x
0x78	0x0078	y
0x79	0x0079	z
0x7A	0x007A	ä
0x7B	0x00E4	ö
0x7C	0x00F6	ñ
0x7D	0x00F1	ü
0x7E	0x00FC	à
0x7F	0x00E0	

## Character Set Table CS2: (ASCII <-> UTF-8)

The following table shows the conversion between the ASCII and UTF-8 character sets.

ASCII-7bit Byte Encoding	UTF-8 Bit Encoding
00 - 7F	0xxxxxxx

## Character Set Table CS3: (UCS-2 <-> UTF-8)

The following table shows the conversion between the UCS-2 and UTF-8 character sets.

UCS2		UTF-8		
Byte Encoding	Bit Encoding	Byte 1	Byte 2	Byte 3
<b>0000 - 007F</b>	00000000xxxxxx x	0xxxxxxx		
<b>0080 - 07FF</b>	00000yyyyyxxxxx x	110yyyyy	10xxxxxx	
<b>0800 - FFFF</b>	zzzzyyyyyyxxxxxx	1110zzzz	10yyyyyy	10xxxxxx

**Note:** Conversion from the default GSM alphabet to the above character set is straightforward. Conversions of the characters listed below the table are not supplied.

## Character Set Table CS6: (UCS-2 Full table)

Character Set Table CS6: (UCS-2) is provided on CD due to its size.

## Character Set Table CS7: (ASCII table)

The following table shows the conversion for the ASCII character set.

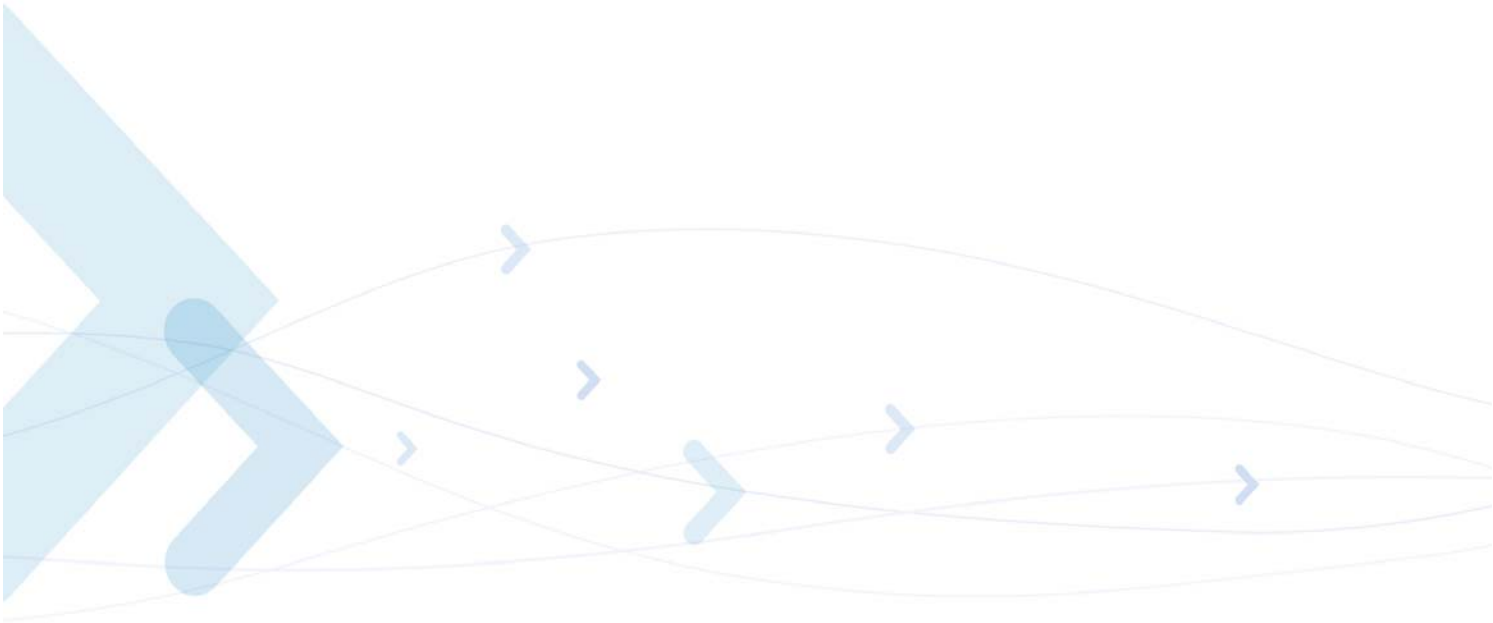
Decimal	Octal	Hex	Binary	Value	Description
<b>000</b>	000	000	00000000	NUL	(Null char.)
<b>001</b>	001	001	00000001	SOH	(Start of Header)
<b>002</b>	002	002	00000010	STX	(Start of Text)
<b>003</b>	003	003	00000011	ETX	(End of Text)
<b>004</b>	004	004	00000100	EOT	(End of Transmission)
<b>005</b>	005	005	00000101	ENQ	(Enquiry)
<b>006</b>	006	006	00000110	ACK	(Acknowledgment)
<b>007</b>	007	007	00000111	BEL	(Bell)
<b>008</b>	010	008	00001000	BS	(Backspace)
<b>009</b>	011	009	00001001	HT	(Horizontal Tab)
<b>010</b>	012	00A	00001010	LF	(Line Feed)

Decimal	Octal	Hex	Binary	Value	Description
011	013	00B	00001011	VT	(Vertical Tab)
012	014	00C	00001100	FF	(Form Feed)
013	015	00D	00001101	CR	(Carriage Return)
014	016	00E	00001110	SO	(Shift Out)
015	017	00F	00001111	SI	(Shift In)
016	020	010	00010000	DLE	(Data Link Escape)
017	021	011	00010001	DC1	(XON)(Device Control 1)
018	022	012	00010010	DC2	(Device Control 2)
019	023	013	00010011	DC3	(XOFF)(Device Control 3)
020	024	014	00010100	DC4	(Device Control 4)
021	025	015	00010101	NAK	(Negative Acknowledgment)
022	026	016	00010110	SYN	(Synchronous Idle)
023	027	017	00010111	ETB	(End of Trans. Block)
024	030	018	00011000	CAN	(Cancel)
025	031	019	00011001	EM	(End of Medium)
026	032	01A	00011010	SUB	(Substitute)
027	033	01B	00011011	ESC	(Escape)
028	034	01C	00011100	FS	(File Separator)
029	035	01D	00011101	GS	(Group Separator)
030	036	01E	00011110	RS	(Request to Send)(Record Separator)
031	037	01F	00011111	US	(Unit Separator)
032	040	020	00100000	SP	(Space)
033	041	021	00100001	!	(exclamation mark)
034	042	022	00100010	"	(double quote)

Decimal	Octal	Hex	Binary	Value	Description
035	043	023	00100011	#	(number sign)
036	044	024	00100100	\$	(dollar sign)
037	045	025	00100101	%	(percent)
038	046	026	00100110	&	(ampersand)
039	047	027	00100111	'	(single quote)
040	050	028	00101000	(	(left/opening parenthesis)
041	051	029	00101001	)	(right/closing parenthesis)
042	052	02A	00101010	*	(asterisk)
043	053	02B	00101011	+	(plus)
044	054	02C	00101100	,	(single quote)
045	055	02D	00101101	-	(minus or dash)
046	056	02E	00101110	.	(dot)
047	057	02F	00101111	/	(forward slash)
048	060	030	00110000	0	
049	061	031	00110001	1	
050	062	032	00110010	2	
051	063	033	00110011	3	
052	064	034	00110100	4	
053	065	035	00110101	5	
054	066	036	00110110	6	
055	067	037	00110111	7	
056	070	038	00111000	8	
057	071	039	00111001	9	
058	072	03A	00111010	:	(colon)
059	073	03B	00111011	;	(semi-colon)
060	074	03C	00111100	<	(less than)
061	075	03D	00111101	=	(equal sign)
062	076	03E	00111110	>	(greater than)
063	077	03F	00111111	?	(question mark)
064	100	040	01000000	@	(AT symbol)
065	101	041	01000001	A	
066	102	042	01000010	B	

Decimal	Octal	Hex	Binary	Value	Description
067	103	043	01000011	C	
068	104	044	01000100	D	
069	105	045	01000101	E	
070	106	046	01000110	F	
071	107	047	01000111	G	
072	110	048	01001000	H	
073	111	049	01001001	I	
074	112	04A	01001010	J	
075	113	04B	01001011	K	
076	114	04C	01001100	L	
077	115	04D	01001101	M	
078	116	04E	01001110	N	
079	117	04F	01001111	O	
080	120	050	01010000	P	
081	121	051	01010001	Q	
082	122	052	01010010	R	
083	123	053	01010011	S	
084	124	054	01010100	T	
085	125	055	01010101	U	
086	126	056	01010110	V	
087	127	057	01010111	W	
088	130	058	01011000	X	
089	131	059	01011001	Y	
090	132	05A	01011010	Z	
091	133	05B	01011011	[	(left/opening bracket)
092	134	05C	01011100	\	(back slash)
093	135	05D	01011101	]	(right/closing bracket)
094	136	05E	01011110	^	(caret/circumflex)
095	137	05F	01011111	_	(underscore)
096	140	060	01100000	`	
097	141	061	01100001	a	
098	142	062	01100010	b	

Decimal	Octal	Hex	Binary	Value	Description
099	143	063	01100011	c	
100	144	064	01100100	d	
101	145	065	01100101	e	
102	146	066	01100110	f	
103	147	067	01100111	g	
104	150	068	01101000	h	
105	151	069	01101001	i	
106	152	06A	01101010	j	
107	153	06B	01101011	k	
108	154	06C	01101100	l	
109	155	06D	01101101	m	
110	156	06E	01101110	n	
111	157	06F	01101111	o	
112	160	070	01110000	p	
113	161	071	01110001	q	
114	162	072	01110010	r	
115	163	073	01110011	s	
116	164	074	01110100	t	
117	165	075	01110101	u	
118	166	076	01110110	v	
119	167	077	01110111	w	
120	170	078	01111000	x	
121	171	079	01111001	y	
122	172	07A	01111010	z	
123	173	07B	01111011	{	(left/opening brace)
124	174	07C	01111100		(vertical bar)
125	175	07D	01111101	}	(right/closing brace)
126	176	07E	01111110	~	(tilde)
127	177	07F	01111111	DEL	(delete)





## Appendix B: MUX

---

### PREMUX State

Entry to State:

- When the C24 powers up.

Exit from state:

- When the DTE sends the +MMUX command to the C24 to start the MUX stack and the C24 acknowledges with an OK response. (The MUX-Init state then begins.)

### MUX-Init State

This state has two phases:

- The 1st phase is the very short period when the C24 is getting ready to communicate with the DTE over the MUX protocol.
- The 2nd phase is when the C24 is ready and is waiting for the DTE to begin using the MUX protocol by sending a special low-level byte sequence (SABM0 frame).

Entry to state:

- When the C24 receives the +MMUX command and returns a success response (OK).

Exit from state:

- If a timeout occurs due to the failure of the C24 to receive the SABM0 frame after a predefined interval. The C24 then returns to the PREMUX state. The interval is defined to 10 seconds.
- If the RS232 connection is closed, the C24 returns to the PREMUX state.
- After a SABM0 frame is received, the C24 moves on to the MUX state.

## MUX State

Entry to state:

- When the C24 receives the SABM0 frame.

Exit from state:

- When the DTE requests the C24 to return to the PREMUX State.

## MUX Modes

The following table describes the differences between each mode in a non-ERM environment.

**Table B-1: MUX Mode Differences**

Feature	Basic Mode	Advanced Mode
Start flag	0xF9	0x7E
Close flag	0xF9	0x7E
Length field	Yes	No
Data transparency	No	Yes
Frame	UIH (or UI)	UIH (or UI)
Processing cost	Low	High
Recovery of synchronization	Slow	Quick

**Note:** The length is still required in the information field of the UIH frame.

## Advance Mode Transparency Mechanism

There is a set of protected characters that cannot appear between the start and end flags. These characters are protected by the transparency mechanism within the following fields: address, control, information and FCS. This mechanism is detailed in the packing/unpacking subsections that follow.

**Table B-2: Protected Characters**

Protected Characters	Value	Encoded Value
Flag sequence (SOF, EOF)	0x7e	0x7d, 0x5e
Control escape	0x7d	0x7d, 0x5d
XON	0x11	0x7d, 0x31
XOFF	0x13	0x7d, 0x33

## Advance Mode Frame Packing

The transmitter (referring to the sender of a frame) examines the frame between the opening and closing flag sequences (including the address, control and FCS fields) and, following completion of the FCS calculation, does the following:

- When encountering protected characters, complements the 6th bit of the octet (XOR with 0x20).
- Inserts a control escape octet immediately preceding the octet resulting from the above, prior to transmission.

## Advance Mode Frame Unpacking

The receiver (referring to the receiver of a frame) examines the frame between the two flag octets. Upon receipt of a control escape octet, and prior to FCS calculation, it does the following:

- Discards the control escape octet.
- Restores the octet that immediately follows by complementing its 6th bit (XOR with 0x20).

## MUX State Procedures

Valid channel indexes in MUX state are 0 to 4, where 0 is the index of the control channel and 1-4 are indexes of the information channels (IDLC).

The following table describes the basic procedures (Open/Close/Err) performed when the C24 is in MUX state.

**Table B-3: MUX State Procedures**

Procedure	Description
<b>Unrecognized Frames/Invalid Frames</b>	The C24 ignores unrecognized and invalid frames.
<b>SABMi Reception – Channel Establishment</b>	Upon receiving a SABMi frame (i = channel index), the C24 checks whether i is within the valid range and is not already established. It then tries to establish the new channel. If the C24 succeeds, it sends a UA frame. If it is not successful, it sends a DM frame.
<b>DISCi Reception – Disconnect Channel</b>	Upon receiving a DISCi frame (i = channel index), the C24 checks whether i is within the valid range and represents an open channel. If so, the C24 attempts to close the channel. If the C24 is successful, it sends a UA frame. If it is not successful, it sends a DM frame. Closing a channel hangs up any active CDSs. However, active voice calls are not hung up, even after the IDLC is closed.

## UIH Frames

Unnumbered information (UIH) frames contain only a Header checksum. There are two types of UIH frames:

- Data transfer frames destined to a specific IDLC channel. The C24 MUX distributes the data inside the UIH frame to the relevant IDLC.
- Control frames being sent between the two MUX control channels. Upon receiving a UIH frame, the C24 acknowledges by sending back the same frame to the DTE with the c/r bit changed.

## Test UIH Control Frames

Upon receiving a Test frame, the C24 sends back a test frame response to the DTE. This test mechanism lets the DTE "know" that the C24 MUX is communicating.

## MSC UIH Control Frame – Virtual Channel V.24 signals

The MUX basic mode should work with RS232 UART HW flow control only.

It is also recommended in the MUX Advanced mode.

The MSC frame reflects the current IDLC v.24 signal status. The C24 stores eight statuses for each established IDLC. The signals are divided into two groups:

- M\_FC, RI, DCD, CTS, DSR
- D\_FC, RTS, DTR

A change in the status of the first group of signals can be made only by the C24. A change in the status of the second group of signals can be made by a specific channel in DTE (IDLC).

When a change is made by the C24 to the status of any of the first group of signals in an IDLC, it sends an MSC frame to the DTE with the new status, as follows:

- **M\_FC** - The (FC) bit is set to 1(off) when the C24 is unable to accept frames through IDLC.
- **RI** - When an IDLC receives an incoming call alert, it updates the RI signal value, similar to what is done in GRLC. The C24 sends the MSC "RI on" frame, followed 1 second later by an MSC "RI off" frame, followed 4 seconds later by another "RI on" frame. This pattern repeats until the incoming call alert is halted.
- **DCD** - Each IDLC changes its virtual DCD according to its specific &C setting (like in GRLC). Upon a change in an IDLC DCD status, the C24 sends the MSC DCD frame. This change in DCD status is dependent on a change to an &C value.
- **CTS** - The C24 will NOT change its CTS signal status value in any case. The IDLC CTS signal value will always be 1 (ON).
- **DSR** - When an IDLC is opened via the SABMi command, the C24 sends an MSC frame to the DTE. In this MSC frame the DSR bit is set to ON. When an IDLC is closed via the DISCi command, the C24 sends an MSC frame to the DTE. In this MSC frame, the DSR bit is set to OFF.

**Note:** The first MSC frame sent from C24 to a specific IDLC after a SABMi command keeps its default values, which are: "M\_FC on", "RI off", "DCD off" and "CTS on".

When a change is made by a DTE-specific IDLC to the status of any of the second group of signals, it sends an MSC frame to the C24 with the new status, as follows:

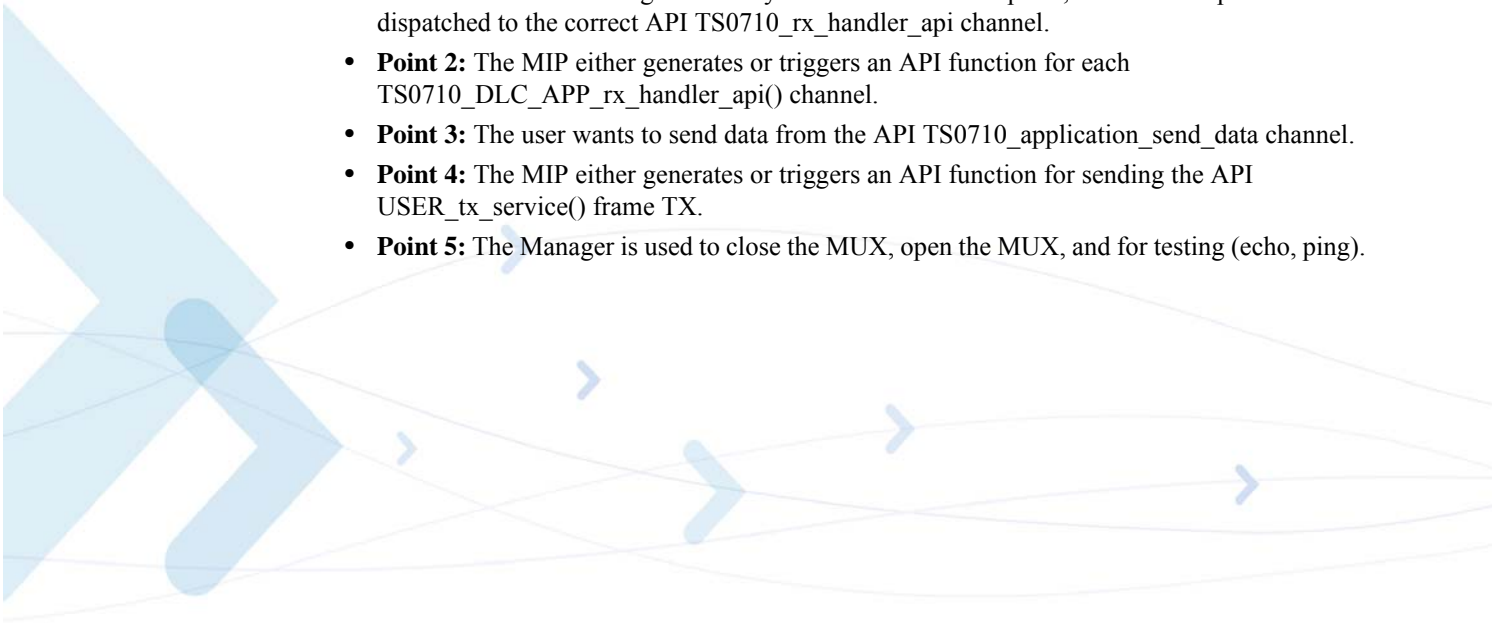
- **D\_FC** - The (FC) bit is set to 1(off) when the DTE is unable to accept frames through IDLC.
- **DTR** - The C24 passes on to the relevant IDLC the change in its DTR signal. The IDLC reacts to the DTR change according to its AT&D setting (like in GRLC). When an IDLC has its DTR set to OFF, no AT command or data will be conveyed to or from it.

**Note:** The reception or sending of MSC frames does not affect the C24 hardware RS232 pins.

## MUX Customer Open Source Code Packet

Each of the following points represents an API user interface:

- **Point 1:** The RX data is generated by the user ISR. At this point, the data is unpacked and dispatched to the correct API TS0710\_rx\_handler\_api channel.
- **Point 2:** The MIP either generates or triggers an API function for each TS0710\_DLC\_APP\_rx\_handler\_api() channel.
- **Point 3:** The user wants to send data from the API TS0710\_application\_send\_data channel.
- **Point 4:** The MIP either generates or triggers an API function for sending the API USER\_tx\_service() frame TX.
- **Point 5:** The Manager is used to close the MUX, open the MUX, and for testing (echo, ping).



The following figure illustrates a MUX user packet, which has a maximum of four virtual channels.

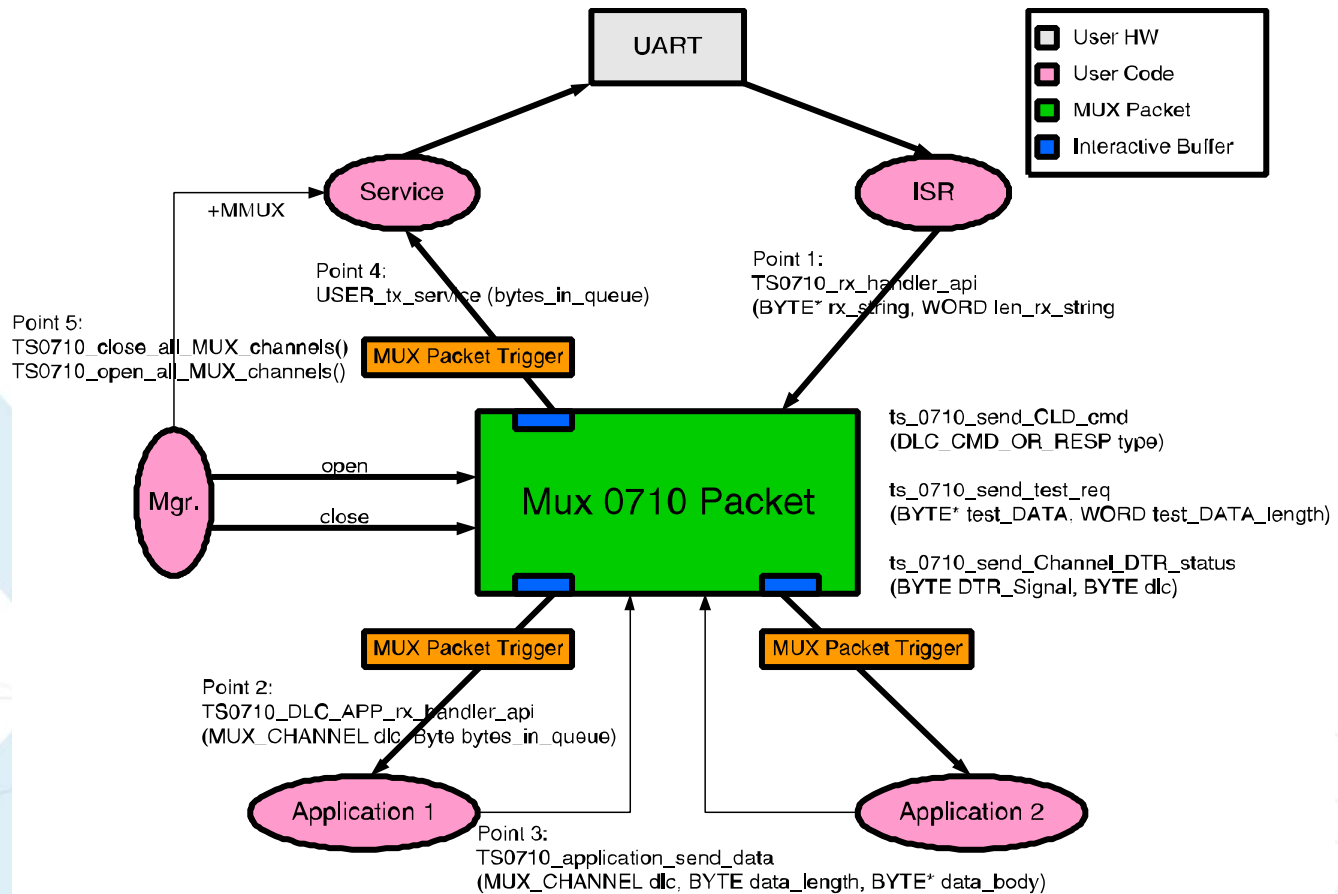


Figure B-1: MUX Integration Packet

## APIs

There are five API user integrations, as follows:

- Open service
- Close service
- Sending Data service
- Receiving Data service
- MUX service test, MSC, FC and so on (refers only to the control channel)

## Open Service

The API Open Service MIP and MUI procedures are as follows:

- MIP: Use API TS0710\_open\_all\_MUX\_channels().
- MUI:
  1. Send establish for control channel (27.010 SABM command frame for Channel 0).

2. Wait for ACK (27.010 UA command frame).
3. Send up to four establish command frames for the data channels (27.010 SABM command frame for Channel 1).
4. Wait for ACK frames (27.010 UA command frame).

## Close Service

The API Close Service MIP and MUI procedures are as follows:

- MIP:
  1. Use API TS0710\_close\_all\_MUX\_channels().
  2. Wait for all ACKs (27.010 UA command frame).
- MUI:
  1. Send release for last opened information channels (27.010 DISC command frame for Channels 1-4).
  2. Wait for ACK (27.010 UA command frame).
  3. Send release for control channel (27.010 DISC command frame for Channel 0) or 27.010 CLD command frame.
  4. Wait for ACK (27.010 UA command frame).

## Sending Data Service

The API Sending Data Service MIP and MUI procedures are as follows:

- MIP: Use API TS0710\_application\_send\_data (MUX\_CHANNEL dlc, BYTE data\_length, BYTE \*data\_body).
- MUI: Use UIH frame with the data encapsulated for sending Channel 1-4 data.

## Receiving Data Service

The API Receiving Data Service MIP and MUI procedures are as follows:

- MIP:
  1. Use API BYTE TS0710\_rx\_handler\_api (BYTE\* rx\_string, WORD len\_rx\_string) for unpack frames.
  2. Use TS0710\_DLC\_APP\_rx\_handler\_api (MUX\_CHANNEL dlc, BYTE bytes\_in\_queue) for reading the arrival data from the channel buffer void.
- MUI: Create data unpack.

## MUX Service Test

Includes MSC, FC, and so on (all to control channel). For the following service functions, refer to [Figure B-1](#)

- MIP:
  1. Void ts\_0710\_send\_CLD\_cmd (DLC\_CMD\_OR\_RESP type).

2. Void ts\_0710\_send\_test\_req (BYTE\* test\_DATA, WORD test\_DATA\_length).
3. Void ts\_0710\_send\_Channel\_DTR\_status (BYTE DTR\_Signal, BYTE dlc).
4. Void ts\_0710\_send\_test\_req (BYTE\* test\_DATA, WORD test\_DATA\_length).

## MUX Open Service

To open the MUX service:

1. Send the AT+MMUX command to the C24 for initiation of the GSM 27.010 protocol.
2. Wait for the OK response.
3. Open the MUX within ten seconds (otherwise, the C24 will exit the MUX mode and revert back to PREMUX state).

A maximum of five channels can be opened: One channel for control, and four channels for information.

A minimum of two channels must be opened: The control channel, and data channel.

## MUX Close Service

To close the MUX service:

1. Close all CSD/1x data call connections.
2. Close all data channels (DLC - DLC4).
3. Close MUX, or channel 0 (DLC0), or toggle the hardware DTR signal (to be implemented in future releases).

## Data Transfer

After all the MUX channels are opened, the user can send and receive data over the four virtual channels (Channels 1 to 4). The user can also send and receive MUX command data on the control channel (DLC0), as when testing for an echo.



## Acronyms and Abbreviations

Abbreviation	Full Name
<b>A</b>	
<b>ACCH</b>	AT Command Channel - Used for AT-commands, TCP/IP, Voice-Call, and SMS applications
<b>AT</b>	AtTention. This two-character abbreviation is always used to start a command line to be sent from DTE to DCE
<b>C</b>	
<b>CSD</b>	Circuit Switch Data
<b>D</b>	
<b>DCE</b>	Data Communication Equipment (C24)
<b>DCSs</b>	Data Coding Schemas
<b>DLC</b>	Data Link Connection
<b>DLC0</b>	The multiplexer control channel.
<b>DLCI</b>	Data Link Connection Identifier
<b>DSP</b>	Digital Signal Processor
<b>DSR</b>	Data Set Ready
<b>DSR</b>	MGOM is ON and ready to communicate with the DTE device.
<b>DT</b>	Discharge Time
<b>DTE</b>	Data Terminal Equipment (such as terminals, PCs and so on). Also called Application Processor (AP).
<b>DTMF</b>	Dual-Tone Multi-Frequency
<b>DTR</b>	Data Terminal Ready
<b>E</b>	
<b>EF</b>	Elementary Files
<b>EONS</b>	Enhanced Operator Name String
<b>ERM</b>	Error Recovery Mode
<b>ESC</b>	Exit to Command Mode from Data Mode (usually the +++ sequence)
<b>ETSI</b>	European Telecommunication Standards Institute

Abbreviation	Full Name
--------------	-----------

## F

**FCC** Federal Communications Commission (U.S.)

**FO** First Octet

**FTA** Full Type Approval

## G

**GCF** GSM Certification Forum

**GGSN** Gate GPRS Support Node

**GPIO** General Purpose Input/Output

**GPRS** General Packet Radio Service

**GR232CFG** The real RS232 HW lines configuration (in PREMUX).

**GRLC** General RS232 Logical Channel - This channel can handle the 07.07/07.05 AT command set (CSD, FAX, GPRS, Voice, Network AT, and so on.)

**GSM** Global System for Mobile Communications

## H

**HCO** Hearing Carry Over allows Speech Disabled callers who can hear well on the telephone to listen directly to the person they are talking with. The Speech Disabled Relay user types his or her part of the conversation on a TTY. A Communication Assistant (CA) then speaks the typed conversation, word for word, to the standard telephone user.

Abbreviation	Full Name
<b>I</b>	
<b>IC</b>	Integrated Circuit
<b>ID</b>	Identification
<b>IDLC</b>	Information DLC - refers to all the data channels except the control channel.
<b>IMEI</b>	International Mobile Equipment Identification.
<b>ISR</b>	Interrupt Service Routine
<b>ITU</b>	International Telecommunication Union
<b>L</b>	
<b>LCA</b>	Low Cost Architecture
<b>M</b>	
<b>MCC/MNC</b>	Mobile Country Code / Mobile Network Code
<b>ME</b>	Mobile Equipment
<b>MGOM</b>	Motorola C24 GSM OEM Modem, also called Base Band processor.
<b>MIDs</b>	Message IDs (Channels)
<b>MO</b>	Mobile Originated - sets up a call session.
<b>MR</b>	Message Reference
<b>MT</b>	Mobile Terminated - accepts a call session.
<b>MUX</b>	Multiplexer entity
<b>O</b>	
<b>OA</b>	Origination Address
<b>OEM</b>	Original Equipment Manufacturer
<b>P</b>	
<b>P2K</b>	Platform 2000
<b>PCB</b>	Printed Circuit Board
<b>PCM</b>	Pulse Code Modulation
<b>PDN</b>	Packet Data Network
<b>PDU</b>	Packet Data Unit
<b>PID</b>	Protocol Identifier
<b>PLMN</b>	Public Land Mobile Network
<b>PPP</b>	Point-to-Point Protocol

Abbreviation	Full Name
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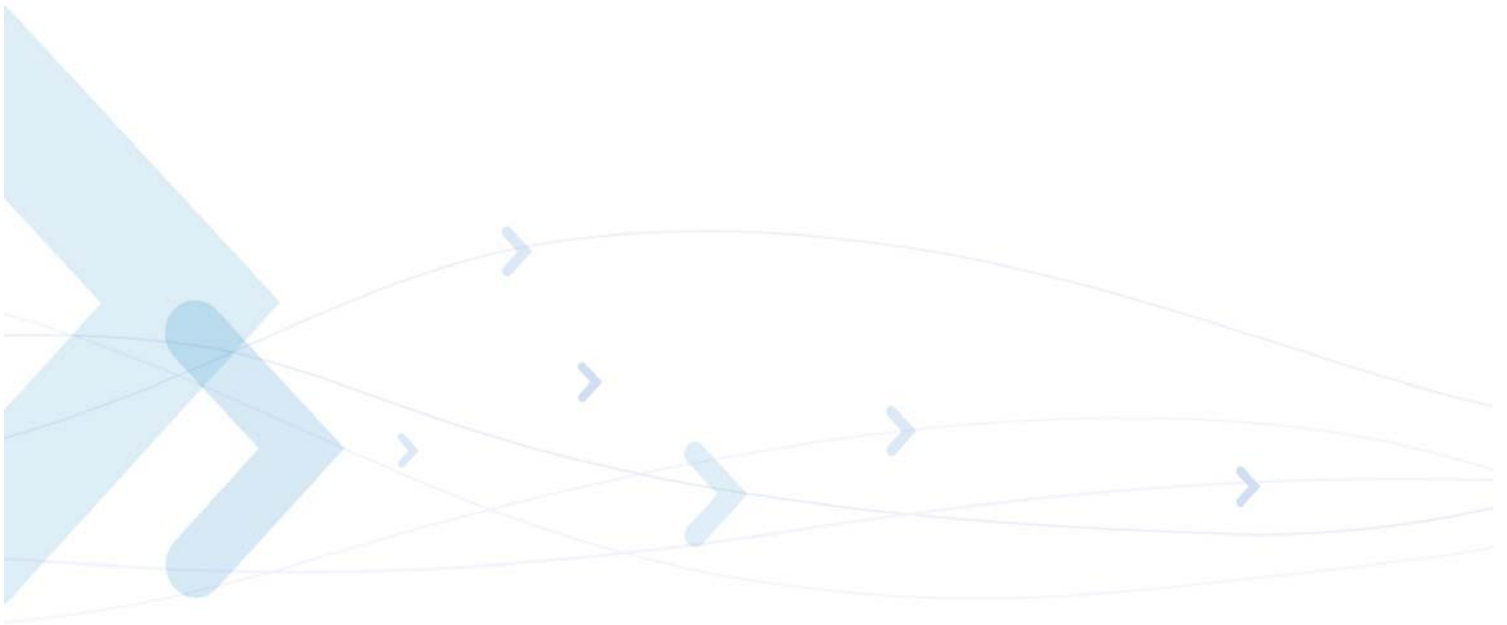
## Q, R

<b>QoS</b>	Quality of Service
<b>RA</b>	Recipient Address
<b>RI</b>	Ring Indicator
<b>RTS</b>	Request To Send
<b>RTS</b>	RS232 pin used for HW flow control. The DTE uses this pin to stop data transmission from the MGOM (on the RXD pin).
<b>RXD</b>	DTE received data from MGOM.

## S

<b>S-register</b>	Software Resister
<b>SC</b>	Service Center
<b>SCA</b>	Service Center Address
<b>SCTS</b>	Service Center Time Stamp
<b>SIM</b>	Subscriber Identity Module
<b>SM</b>	Short Message
<b>SMS</b>	Short Message Service
<b>SN</b>	Serial Number
<b>SSL</b>	Secure Socket Layer protocol. Created by Netscape to ensure secure transactions between a client and a server.
<b>ST</b>	Status
<b>SW flow control</b>	ISO/IEC 646 SW flow control (the DC1/XON and DC3/XOFF control characters).

Abbreviation	Full Name
<b>T</b>	
<b>TBD</b>	To Be Defined
<b>TDMA</b>	Time Division Multiple Access
<b>TE</b>	Terminal Equipment
<b>TLS</b>	Transport Layer Security protocol for establishing a secure connection between a client and a server. TLS is based on SSL 3.0 protocol.
<b>TODA</b>	Type of Destination Address
<b>TOOA</b>	Type of Origination Address
<b>TORA</b>	Type of Recipient Address
<b>TOSCA</b>	Type of SCA
<b>TTY</b>	Tele Typewriter
<b>TXD</b>	DTE transmit data to MGOM
<b>U</b>	
<b>UA</b>	Unnumbered Acknowledgement
<b>UIH</b>	Unnumbered Information, with Only Header Checksum
<b>USB</b>	Universal Serial Bus
<b>V</b>	
<b>VCO</b>	Voice Carry Over. This is available for people who cannot hear but are able to speak clearly. During a VCO relay call, the Deaf or Hard of Hearing caller speaks directly to the person they are conversing with. When that person responds, a Communication Assistant (CA) types back exactly what is said to the screen of the TTY or VCO phone.



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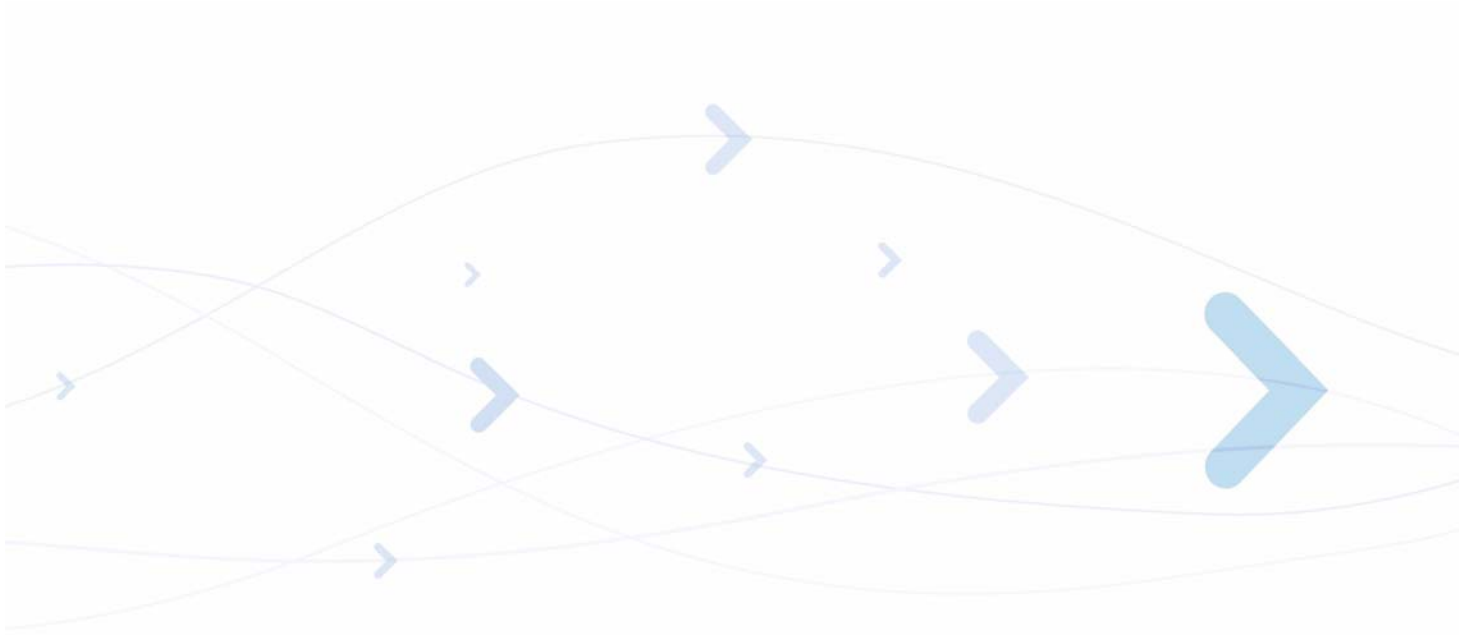
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**6802985C51-B**